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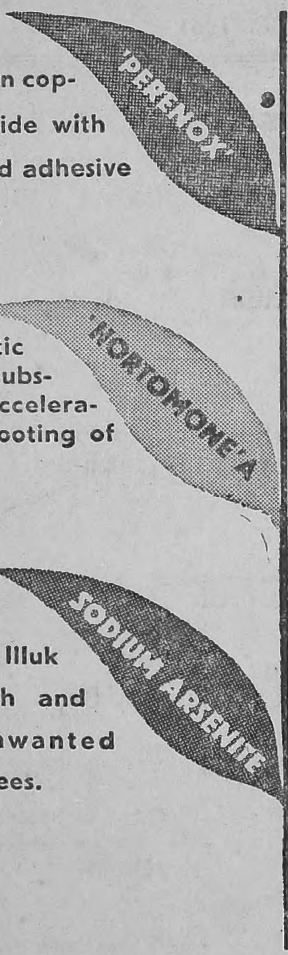

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PERCIVAL VENKATARAMIAH

Principal, College of Agriculture, Bapatla

(Born 2nd December 1896 — Died 23rd October 1951)

The Madras Agricultural Journal

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Editorial

Obituary : We record with deep sorrow the death of Mr. P. V. Ramiah, Principal of the Bapatla College of Agriculture, on 23rd October, 1951. In this, the Department, as well as the Madras Agricultural Students' Union, has sustained a very severe loss. Born in December 1896, of a distinguished and intellectual family in Ganjam, Mr. Ramiah had his early education in the Christian College, Madras and then went up to Edinburgh, where he took the degrees of M.A., B.Sc., and on his return was appointed as Assistant Chemist in the Agricultural Research Institute at Coimbatore in December 1922. Thereafter he rose to occupy successively the posts of Government Agricultural Chemist, Principal of the Agricultural College at Coimbatore and later on at Bapatla, where he continued till his death. For a short time in 1943, Mr. Ramiah was also acting as the Director of Agriculture. It is indeed sad to think that Mr. Ramiah, who was due to retire this year on December 3rd, did not live to enjoy his retirement after such a long and meritorious period of service.

As a scientist, he had a remarkable faculty of going straight to the essentials of any problem and in the field of animal nutrition, Mr. Ramiah was practically the pioneer worker in the whole of India. He started the Animal Nurition Section in 1927 at Coimbatore and the system of feeding minerals to milch and work animals that is now being adopted as a routine practice in our Department, owes its introduction to Mr. Ramiah's work in this field. He was also an authority on black soils and was the leading worker in the Soil Survey of the Tungabhadra

Project Area and the present work on the construction of the dam is based on the findings of this Survey work. As an administrator and in guiding the work of younger men, he was eminently successful, being always helpful in outlook and constructive in his criticisms.

As a man he was a very lovable personality, with a kind heart and a keen sense of humour; he was also quite a brilliant conversationalist.

He was taking a keen interest in the Madras Agricultural Students' Union and we remember with gratitude the able manner in which he helped in the production of skits and playlets, in connection with the College Day entertainment in the earlier years.

His premature death before retirement is a great loss to all those who had the privilege of knowing him at close quarters. We extend our heartful sympathy to his aged mother, two daughters and two brothers.

The Evaluation of Residual Deposits of DDT.

[2, 2,-bis (P-Chlorophenyl) 1, 1, 1-trichloro-ethane] by chemical and biological methods** and the correlation existing between them. Part III

By

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Introductory: Investigations reported in the earlier articles (Satyanarayana, 1951), showed that the amount of DDT recovered from the surfaces of apple leaves varied with the mode of deposition, the nature of the solvent used, and the concentration of the insecticide in the preparation. The nature of the emulsifer used had but little effect, the percentage of the solvent in the preparation and the nature of the surface (upper or lower) though having some slight effect did not appear to be of much consequence. Though under the experimental procedure adopted in the present investigation it has not been possible to recover all the DDT initially deposited, it was shown that either by prolonging the period of shaking or by continued extraction in a soxhlet cent percent recovery was possible. It was, therefore, clear that the material that was not recovered was not lost by any other process like the catalytic decomposition by leaf tissue, etc., but could be recovered.

Absorption of insecticides into the plant tissue is not a new idea. Swain (1933), working with petroleum oils observed this and suggested a differentiation between the 'available' i.e. the insecticidally useful, and the 'non-available' or the locked up portions. Probably, a similar differentation needs to be made in the case of DDT also. In a way this fact seems to have been realized by Barlow and Hadaway (1949), when they designated the two fractions of DDT as 'inner' and 'outer'.

Object and scope of the present investigations: In view of the foregoing considerations further elucidation of the following points is clearly necessary:—

1. If one is dealing with a material treated with DDT., what is the most suitable method of extracting all the insecticidally useful portion ?

2. What is the insecticidal value of that portion which is not recovered by the method which is considered most appropriate ? and

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** The investigations reported in this contribution formed part of a thesis submitted for the Ph. D. degree of the University of London, and were condcted at the East Malling Research Station, England, during the years 1946-'47.

3. Is it possible to establish any relationship between values obtained by chemical estimation and those obtained by biological tests ?

Methods and Materials: In reviewing the literature on extraction procedure (Satyanarayana 1951), it was shown that the methods adopted varied a lot from mere washing with a jet of benzene to a shaking period of 15 – 30 minutes. Naturally, the amounts of DDT recovered by these two methods cannot be the same, and the results presented in the earlier article also confirmed it. Considering all aspects of the problem it was decided to confine attention to preparations made with a low boiling solvent like benzene and a high boiling solvent like dekalin in the preparation of emulsions and solutions, and estimate the relative toxicities of deposits both by chemical and biological tests. A few trials with a suspension were also included for the sake of comparison. Since the effect of the surface (upper or lower) on the recovery of the insecticides was found to be insignificant, and as it also appeard to be more practicable to spread the deposits uniformly on the upper than on the lower surface due to the absence of veins and midrib, the experiments were restricted to the upper surface only. With the idea of confirming the absorption of the insecticide by the leaf tissue a non-absorbent surface like glass was also included in the tests for comparative purposes.

In the conduct of biological tests, when glass surfaces were employed, the technique described in the earlier communication was followed (Satyanarayana, P. 1951, 2). But in cases were leaf surfaces were used, squares 8 sq. cm. in area were cut from fresh and clean apple leaves (Variety, Cox's Orange Pippin) and after placing them flat in petri dishes, measured amounts of the insecticide were deposited as usual with a micropipette and spread uniformly without allowing them to overflow the edges. After the deposits on leaves had dried, which usually happened in 1 – 2 hours, the squares were cut into circles and fitted into the caps of "Universal" sample bottles (18 – 19 mm. internal diameter) fitted with rubber washers. The required number of insects were transferred to each bottle and the cap containing the leaf circle gently screwed on. The bottle was finally inverted thereby causing the insects to fall on to the leaf surface, and then left in the incubator at 25°C till taken out for counting after 144 hours.

Regarding the period that should lapse between the deposition of the insecticide and the transference of insects on the leaf surface, no hard and fast rule is available. Gunther (1946), in his spraying experiments with kerosene solutions and emulsions on fruit trees observed that the insecticide first penetrated the tissue along with the solvent but subsequently reappeared on the surface during the next 24 hours. He therefore, suggested that when samples are drawn for analysis it is better to do so 24 hours after spraying by which time the insecticide would have had ample time to stabilize itself. A few preliminary experiments were conducted on this aspect to ascertain the minimum period that should lapse between the deposition of the insecticide and the transference of insects. DDT emulsions of 0·04% and 0·02% strength prepared by using benzene as solvent were deposited on exactly measured leaf surfaces and the insects transferred at 2, 4, 8, 16 and 24 hours after the deposition of the insecticide (Table I)

TABLE I

The influence of time interval between the deposition of the insecticide and the transference of insects on the percentage kill.

Benzene emulsion on leaf — counted after 7 days.

Concentration of DDT in the preparation %	Micrograms of DDT per sq. cm.	Interval between *deposition of* insecticide and transference of insects hours		*Number* of insects used	Number dead	% dead
0·04	5·0	2	(1)	91	63	69·2
		4		90	66	73·3
		8		89	49	55·0
		16		90	68	75·5
		24		89	61	68·5
0·02	2·5	2	(2)	91	18	20·0
		4		99	33	33·3
		8		90	24	26·6
		16		90	32	35·5
		24		90	32	35·5

Statistical examination of data in Table 1 :—

(1) The data do not appear to be homogeneous since p = 0·05 — 0·02; for p = 00·5 = 9·488, but the value actually obtained is 10·606 (4 df) which is very close to the expected value.

(2) p = 0·01 — 0·5, i.e., the data are homogeneous.

Counts taken after 7 days showed that the percentage kills with both the concentrations were independent of the interval that lapsed between the deposition of the insecticide and the transference of insects. In the present investigations, therefore, the insects were transferred to the leaf surfaces as soon as they appeared dry, and this generally happened in 1½ to 2 hours.

Having decided on the technique of the biological experiments the following experiments were conducted to ascertain :—

(1) The optimum quantity of benzene required for stripping all the insecticidally useful part of DDT from the leaf surfaces and test the insecticidal value of washed leaves,

(2) having ascertained the optimum quantity of benzene required for stripping, estimate the amount of DDT recovered when deposited in different forms, and,

(3) Attempt to evaluate the toxic action of deposits when deposited on different surfaces by biological methods, and correlate them with the chemical values.

The p—p' DDT obtained by *recrystallising thrice* the commercial product with alcohol and having a m. p. of 108—109°C, was used in all these investigations.

Estimation of the optimum quantity of benzene required for stripping the insecticidally useful part of DDT and the toxic action of the washed leaves : One percent solutions and emulsions using benzene as the solvent

were deposited on the upper surfaces of apple leaves at the rate of 5.0 micrograms per 100 sq. cm. of leaf area, and after allowing them to remain for 24 hours, the leaves were washed individually with 3, 6, and 9 cc. of benzene per leaf with a wash bottle jet and the extracts collected and analysed by determining the total chlorine content after reduction with sodium and ethyl alcohol (Satyanarayana, 1951). The washed leaves were thoroughly dried and their insecticidal value determined by confining *Tribolium confusum* on them.

TABLE II

Amount of DDT recovered from the surfaces of apple leaves when washed with varying quantities of benzene, and the insecticidal value of washed leaves.

	Chemical estimations				Biological tests		
Leaf area deposited Sq. cm.	Benzene used for washing c. c.	DDT deposited mgm.	DDT recovered mgm. *	Percentage recovered	No. of insects tested	Number dead	Percentage dead
			Solutions				
100	3·0	5·0	3 26	65·3·	55	3	5·6
100	6 0	5·0	2 96	58·9	59	4	6·8
100	9 0	5·0	3 43	68·2	47	3	6·5
Average.				64·1			
			Emulsions				
100	3·0	5·0	3·35	66 71	59	1	2 0
100	6·0	5 0	2 98	59·60	48	1	2·1
100	9·0	5·0	3·23	65 60	60	3	4 9
Average				64.00			

* each value represents the average of four estimations.

The result of chemical and biological tests presented in Table II show that, (1) the amount of DDT recovered is independent of the amount of benzene, and (2) the residual toxic effect of washed leaves is insignificant. In other words, the amount of DDT recovered is the same whether the quantity of benzene used for washing each leaf is 3, 6, or 9 cc. Only 64%, of the material originally deposited is recovered. It, therefore, appears that the effective portion of the insecticide is completely removed even by mere washing and no elaborate shaking or extraction procedure is called for. The unrecovered portion of the insecticide which constitutes nearly one-third of that originally deposited, i. e., 1.7 mgm per 100 sq. cm. of leaf area, or 17 micrograms per 1.0 sq. cm. is practically ineffective as the percentage kill is insignificant. As will be evident from the results presented in the earlier communication (Satyanarayana. II, 1951) 10 micrograms of DDT is ample to give a 100% kill with *Tribolium* in an experimental period of six days. The inability of this unrecovered portion which though of the order of 17 micrograms per 1 sq. cm. to show any effect proves that it is not present in an easily available form to deal with insects of *Tribolium* type that are killed by contact action.

Amount of DDT recovered from the surfaces of leaves by washing following application of different preparations: As a corollary to the foregoing, further experiments were conducted to investigate in detail the

amount of DDT recovered from the surfaces of apple leaves when deposited in the form of solutions, emulsions and suspensions. As representatives of low and high boiling solvents benzene and dekalin were chosen in the preparation of solutions and emulsions, and in the case of suspensions diacetone alcohol at the rate of 25% was used as the solvent. Triton-X-100 at the rate of 1% was used for stabilising in the case of suspensions, and 0.5% sodium oleate as emulsifier in the case of dekalin and benzene emulsions. Solvent at the rate of 10% was used in the preparation of the emulsions. All the preparations were as usual spread on known areas of leaf surfaces to give a concentration of 5 mgm per 100 sq. cm. and after allowing to stand for 24 hours, each leaf was individually washed with 6 cc. of benzene, and the extract obtained analysed as usual. The residual toxicities of the washed leaves were also determined by confining insects on them. The results obtained for chemical and biological tests are presented in Table III. Results obtained for similar preparations when recovery was made by continuous shaking for 15 minutes are also presented side by side for the sake of comparison.

TABLE III

Amount of DDT recovered from the surfaces of apple leaves after depositing in various forms by washing and shaking procedures, and the residual toxicity of the washed leaves.

Solvent used and percentage	Chemical estimation					Biological test			
	Washing Technique			Shaking Technique		Number of insects tested	Number Dead	% Dead	Remarks
	% DDT in the preparation	DDT Deposited mgm.	DDT Recovered mgm.	% Recovered	% DDT Recovered				
Solutions									
Benzene	1·0	5·0	2 587 (1)	51·74	74·75	81	2·0	2·4	Washed leaves
						75	0	0	Controls
Dekalin	1 0	5·0	1·181 (1)	23·62	73·75	77	3	4	Washed leaves
						75	0	0	Controls
Emulsions									
Benzene (10%)	1·0	5·0	3·420 (1)	68·50	90·18	75	0	0	Washed leaves
						73	0	0	Controls
Dekalin (10%)	1·0	5·0	3·345 (1)	66·00	85·48	74	0	0	Washed leaves
						74	0	0	Controls
Suspensions									
Diacetone-alcohol (25%)	0·9034	4 517	3 710 (2)	82·14	91·04	...	...	...	...

(1) Each figure represents average of 4 estimations.
(2) do. do. do. 6 do.

The amounts of DDT recovered by the washing technique are in all cases lower than those obtained by the shaking procedure. The suspensions give the maximum recovery and are followed by emulsions and solutions. The order of recovery either by the washing or shaking technique is the same, but only the actual amounts recovered are

different. The difference in percentage recovery between the washing (82.14%) and shaking procedures (91.04%) is nearly 9% in the case of suspensions which shows that most of the insecticide being in a suspended state is only on the surface and is easily removed by washing. The extra 9% obtained on shaking is probably due to the small quantity of insecticide which penetrated the tissue along with the large quantity of the solvent used in the preparation of the suspension. In the case of emulsions and solutions the differences in recoveries by the two procedures are considerably large, the emulsions occupying an intermediate position between solutions and suspensions. These results are as expected and fit in with theoretical considerations.

TABLE IV

Average percentage recovery values and their relative proportions when DDT is deposited, in different preparations

Name of surface and preparation tested	Extraction procedure adopted		% excess recovery over the washing method	Ratio of shaking to washing procedure	Relative recoveries	
	Washing	Shaking			Washing	Shaking
Benzene solution leaf ...	51·74	74 75	23 01	1·445	1·00	1·00
Benzene emulsion leaf ...	69·50	90·18	21·68	1·310	1·325	1·21
Diacetone-alcohol suspension on leaf ...	82·14	91·04	8·90	1·109	1·590	1·22
Benzene emulsion on glass ...	100·00	100·00	0·00	1·00	1·93	1·34
Dekalin solution on leaf ...	23·62	73·75	50·13	3·10	1·00	1·00
Dekalin emulsion on leaf ...	66·50	85·48	18·58	1·16	2·83	1·16
Diacetone-alcohol suspension on leaf ...	82·14	91·04	8·90	1·109	3·47	1·23

The large percentage difference in recovery found in the case of solutions (Col. 4, Table VI) clearly shows that the insecticide penetrated the tissue and is recoverable only on continued shaking. It is the maximum in the case of dekalin (50·13%) and as already suggested is to be attributed to its greater non-volatility. Considering the relative recovery values, estimating by the washing procedure (cols. 2 and 6 of Table IV) for every one part of DDT recovered when deposited in the form of solution in benzene, 1·325 and 1·590 parts are recovered when deposited as emulsion and suspension respectively. Similarly, considering the relative quantities recovered by the shaking procedure (cols. 3 and 7 of Table IV), they are 1·0, 1·21 and 1·22 respectively. The same sort of relationship is exhibited when the recoveries with dekalin solution, dekalin emulson and diacetone alcohol suspension are considered. The

lower relative recovery values by the shaking procedure suggest, that as a result of prolonged shaking the inequalities due to the nature of preparations i.e., solvent etc., have been levelled up, and more or less uniform conditions established. Values obtained by the washing technique seem to reveal better the differences existing between the different preparations and also fit in very well with theoretical considerations. Dekalin being a solvent with low volatility penetrates deeper and leaves less of the insecticide on the surface to be extracted. Either the washing or the shaking technique is capable of revealing the relative performances of the various preparations, but which of these two is better remains to be decided.

The residual toxicities of the washed leaves were tested in all cases (Table III), and in no case was any significant till recorded, including leaves treated with dekalin solution where only 23% recovery was obtained and a residue of 77%, equal to about 38·2 microgrammes of DDT per sq. cm. was left over. This clearly shows that even quantities of insecticide of this magnitude not recovered by washing are not toxic to insects like *Tribolium* which are killed by contact action and confirms the earlier observations.

Toxicity of DDT when deposited in different forms and on different surfaces: Having found by chemical estimations that the recovery values for DDT when deposited in various forms were different, it was next intended to see whether they could be correlated with their biological performances. In the chemical estimation the concentration of DDT was invariably 1%, and this was purposely chosen in view of the limitations placed on the available analytical methods. As this high percentage would be quite unsuitable for biological tests, from a knowledge gained from preliminary experiments 0·08, 0·04, 0·02, 0·01 and 0·005 percent concentrations were chosen as the most suitable, the test insects being *Tribolium.*

Two sets of experiments were conducted. In the first one the relative biological performances of suspensions, emulsions and solutions were compared, and in the other the effect of the nature of solvent used in the preparation of the emulsion and the nature of the surface tested were compared. The results were statistically examined where-ever necessary and practicable.

The concentration of the solvent used in all these cases (excepting solutions) was 1% and that of the emulsifier 0·05% if it was product M. B. 320, and 0·02 cc. if it was Trition X — 100 (V/V). The required quantities of preparations (0·1 cc. for every 8 sq. cm.) were accurately measured and uniformly spread. The insects were transferred as usual and counted after 144 hours. In Tables V and VI and Chart 1 the results of tests conducted with suspensions, solutions and emulsions on leaf are presented, and in Tables VIII and IX and Chart 2 those with dekalin and benzene emulsions on leaf are presented. With the idea of confirming the absorption of the insecticide by the leaf surface, a non-absorbent surface like glass was included for comparison. The results are considered first on their face value and then statistically examined.

TABLE V

Relative Toxicities of DDT Solutions, Emulsions and Suspensions to *Tribolium confusum*

Age of insects ... 0 to 60 days.
Amount of solvent used in the preparation of emulsions and suspensions 1·0%.
Emulsifier used—Product M. B. 320 at 0·05%.

Nature of preparation	Concentration of DDT in the preparation %	Micro grams of DDT per sq. cm.	Test 1			Test 2		
			No. of insects used	No. dead	Percentage dead	No. of insects used	No. dead	Percentage dead
Glass Surface								
Benzene emulsion	0 08	10·0	89	84	94·4	...	...	...
	0 04	5 0	89	64	80 9	...	...	...
	0·02	2·5	90	62	68·9	...	...	...
	0 01	1 25	90	24	26 7	...	...	...
	0·005	0 625	89	3	3·4	...	...	...
Leaf Surface								
Benzene solution	0·08	10 0	90	53	58·9	91	35	38 4
	0·04	5·0	90	49	54·4	90	6	6·7
	0 02	2·5	92	1	1·1	90	0	0
	0·01	1·25	91	0	0	90	0	0
	0·005	0 625	90	0	0	90	0	0
Benzene emulsion	0 08	10·0	91	87	95 6	85	84	98 9
	0·04	5·0	88	60	68·2	90	64	71·1
	0·02	2·0	91	20	22·0	87	14	16 1
	0 01	1·25	90	1	1·1	90	0	0·
	0 005	0·625	90	0	0	90	0	0
Pyridine suspension	0 08	10·0	90	88	97 8	...	...	...
	0·04	5·00	90	78	86·7	...	...	...
	0 02	2·5	90	24	26 7	...	...	...
	0 01	1·25	90	1	6·7	...	...	...
	0 005	0·625	90	1	1·1	...	...	...
Controls			75	0	0	75	0	0

Considering first the relative performances of suspensions, emulsions and solutions on leaf amongst themselves (Table VI and Chart 1), and of all these against the performance of a benzene emulsion on glass, it is found that L. D. 50 is the lowest on glass (0·0170% or 2·21 micrograms per sq. cm.) which establishes the superiority of non-absorbent glass surface over that of leaf. On leaf, 6·56 micrograms per sq. cm. are needed if it is deposited in form of a solution, 3·91 micrograms in the form of an emulsion, and 2·83 micrograms in form of a suspension. The results, therefore, agree very well with theoretical considerations, and support the conclusions drawn from the chemical estimations. The percentage recovery values in the chemical estimations and their relative proportions, along with the results obtained in the biological tests (L. D. 50'5) are presented in Table VI. It is seen that the percentage recoveries or the relative values obtained in the chemical estimations by the washing technique are more closely related to the biological values than those obtained by the shaking technique. A high percentage recovery by the chemical method gives a low L. D. 50, and vice versa.

TABLE VI

Correlation between chemical estimations and biological tests obtained with suspensions, emulsions and solutions of DDT.

Nature of surface and preparation	Chemical estimations		Biological tests		
	Washing technique and relative values	Shaking technique relative values	L. D. 50 as % DDT in preparation	L. D. 50 as micrograms DDT per sq. cm.	Relative values
Benzene emulsion on glass	1·93, 1·0	1·34, 1·00	0 0178	2·21	1·0, 0·34, ...
Pyridine suspension on leaf	1·59, 0·82	1·22, 0·91	0 0226	2·83	1·28, 0·43, 1 0
Benzene emulsion on leaf	1,33, 0·69	1·21, 0 90	0·0313	3·91	1·77, 0·60, 0·38
Benzene solution on leaf	1·00, 0·52	1·00, 0·75	0·0525	6 56	2·97, 1 0, 2·32

It may, therefore, be stated that the chemical recovery values are roughly inversely proportional to the L. D. 50'5, or in other words, the product of chemical recovery values and L. D. 50 is a fairly constant quantity. Applying this criterion in the present investigations it will be seen that the product of recovery by washing technique and L. D. 50 (excepting the case of solutions) varies from 2·0 — 2·3 (Col. 5, Table VII). On the other hand the product obtained by multiplying the recovery value obtained by the shaking method by L. D. 50 is not so very consistent (Col. 6).

TABLE VII

Relative potencies of the several preparations as judged by the chemical and biological tests and the product of both values.

Nature of preparation and surface	Relative recoveries by chemical estimation		L. D. 50	Product of recovery by chemical estimation X L. D. 50	
	Washing technique	Shaking technique		Washing technique	Shaking technique
(1)	(2)	(3)	(4)	(5)	(6)
Emulsion on glass ...	1·93	1·34	1·00	1·93	1·34
Suspension on leaf ...	1·59	1·22	1·28	2 04	1·56
Emulsion on leaf ...	1·33	1·21	1·77	2·30	2·14
Solution on leaf ...	1·00	1·00	2 97	2·97	2·97

A statistical examination of the data using the results of the first test (Table V), gave the following information.

Comparison:	The regression lines are:	P	L. D. 50%
Emulsion on leaf ...	$\gamma = 4{\cdot}278\ X - 1\ 385$	< 0 9	0·0311 * (0·0313)
Solution on leaf ...	$\gamma = 3{\cdot}244\ X - 0{\cdot}637$	> 0 001	* (0·0546) * (0 0525)
Suspension on leaf ...	$\gamma = 4{\cdot}079\ X - 0{\cdot}678$	0·01–0·001	0·0247 * (0·0226)
Emulsion on glass ...	$\gamma = 2{\cdot}686\ X - 1{\cdot}695$	0· –0·05	0·0170 * (0·0178)

* These are values actually obtained from the graphs and agree very closely with the calculated figures.

Comparison of treatment on glass and leaf (emulsions) gave $\chi^2_a = 44{\cdot}399$ ($P < {\cdot}001$) and $\chi^2_b = 16{\cdot}035$ ($P < {\cdot}001$) indicating the reduced toxicity on the leaf surface. The fact that the two lines depart significantly from parallelism, however, shows that the reduced toxicity of the deposit on the leaf cannot be wholly ascribed to the absorption by the leaf of a constant proportion of DDT applied, — either there is greater absorption from the less concentrated solutions or some other unidentified factors are involved.

Further examination of the results to determine which difference may be regarded as significant gave the following data.

Comparison	χ^2_a	P	χ^2_b	P
Emulsion on glass / Emulsion on leaf	44·339	$<{\cdot}001$	16·035	$<{\cdot}001$
Emulsion on leaf / Solution on leaf	0 572	0·7 — 0·6	0·526	0·7 — 0·6
Emulsion on leaf / Suspension on leaf	1·76	0·3 — 0·2	0·207	0·8 — 0·9
Suspension on leaf / Solution on leaf	2·093	0·2 — 0·1	0·301	0·8 — 0·7

These data again confirm the greater toxicity of a deposit on glass when compared with the same type of deposit on leaf. The apparently greater toxicity of suspension as compared with emulsion and solution agrees with the evidence obtained from the absorption of DDT by the leaf which is greater for the solution and least for the suspension, but the differences shown in the biological test are not significant at a probability level of $P = 0{\cdot}05$. This is largely due to the marked variability of insects in susceptibility, and the deviation of the determined mortality figures from the theoretical linear relationship between log. concentration and probit.

TABLE VIII

The effect of surface and nature of solvent used in the preparation of the emulsion on the toxicity of DDT.

Insect used and age:— *Tribolium confusum* ... 0 — 60 days
Benzene concentration in emulsion ... 1·0%
Emulsifier used; — Sodium oleate ... 0·05%

Solvent used	Concentration of DDT in emulsion %	Micrograms of DDT per cm	Number of insects used	Number dead	% Dead
	Glass Surface				
Benzene	0·08	10·0	60	53	88·3
	0·04	5·0	60	21	51·7
	0·02	5·0	60	19	31·7
	0 01	1·25	60	8	13·3
	0·005	0·625	60	0	0·0
	Leaf Surface				
Dekalin	9·08	10·0	59	53	86·0
	0·04	5·0	59	13	86·0
	0·02	2·5	48	3	6·2
	0·01	1·95	50	3	0·0
	0·005	0·625	33	9	0·0

Solvent used	Concentration of DDT in emulsion %	Micrograms of DDT per cm	Number of insects used	Number dead	% Dead
Benzene	0 08	10·0	50	41	82·0
	0·04	5·0	50	18	36 0
	0·02	2·5	30	8	16·0
	0 01	1·25	50	0	0·0
	9 005	0·625	40	0	0·0
Benzene	0·08	10·0	85	64	75·3
	0 04	5 0	90	39	33·3
	0 02	1·5	88	4	4·5
	0 01	1·25	99	1	1·1
	0 005	0 625	99	0	0 0
Dekalin	0 08	10·0	90	69	76·7
	9·94	5·0	90	14	15·6
	0 02	2·5	88	2	2·3
	0·01	1·25	90	0	·0
	0·005	0·625	90	2	2 2
Controls			45	0	0·0
			50	0	0·0

Test — On leaves fixed to cells and counted after 7 days,
Test — In bottles as usual and counted after 6 days.

TABLE IX

Correlation between chemical estimations and biological tests Benzene and dekalin emulsions on leaf and glass

Nature of surface and preparation	Chemical estimations				Biological tests		
	Washing technique		Shaking technique		D.D. 50 as % DDT in the preparation.	L.D 50 as micrograms per sq. cm.	Relative values.
	Percentage recovery	Relative values	Percentage recovery	Relative values			
Test I							
Benzene emulsion on leaf ...	68·5	1·02	90 18	1·06	0.0468	5 85	1·0, —
Dekalin emulsion on leaf ...	66·9	1·00	85·48	1·00	0·0507	6·34	1·08, —
Test II							
Benzene emulsion on glass ...	100·0	1·50	100·0	1·17	6 0329	4·05	1·0, —
Benzene emulsion on leaf ...	68 5	1·32	90·2	1·057	0·0525	6·56	1·62, 1·0
Dekalin emulsion on leaf ...	66·9	1·00	85·5	1·0	0.0610	7 63	1·88, 1·16

In the other set of experiments where benzene and dekalin were chosen as solvents in the preparation of emulsions (Table VIII and IX, and Chart 2), and compared on glass and leaf surfaces, the L. D. 50's with benzene and dekalin emulsions on leaf were 0·0468% and 0·0507% (i.e. 1 : 1·08) respectively in the first test and 0·052% and 0·0610% (i. e., 1 : 1·16) respectively in the second test, and these bear a close inverse relationship to the chemical recovery values which were obtained as 68·5% for benzene emulsion and 66·9% for dekalin emulsion (Table IX).

That means, for every one unit of DDT deposited in the form of benzene emulsion the amounts required for giving the same percentage kill if dekalin is substituted are 1·08 and 1·16 units respectively as obtained in the two tests. Comparing the relative efficiencies of these two preparations (benzene and dekalin) on leaf against a similar preparation on glass, the latter surface is definitely superior to the former. The L. D. 50 in the case of glass and benzene emulsion is 0·329% (i. e., 4·05 micrograms per sq. cm.), and in the case of leaf and benzene emulsion 0 0525% (6·56 micrograms per sq. cm.). These values are in the ratio of 1·0 : 1·62, which again compares very favourably with the values obtained in the earlier experiments (Table VII), 1·0 : 1·77). That is, for every unit of DDT applied on glass surface in the form of benzene emulsion nearly 1·6 or 1·7 units must be deposited on the leaf surface to produce a similar effect. This is again in close agreement with the chemical recovery values where only 68·5% of DDT was recovered from the leaf surfaces when deposited in the form of benzene emulsion by washing technique (Tables III and IX). In other words for every 100 parts deposited on glass 150 parts of DDT must be deposited on leaf to give an equal effect, a result which is in close agreement with the values obtained in the biological tests (1·6 and 1·7). The chemical recovery values by the washing technique again appear to be related very closely to the biological values but in the inverse proportion. The product of these two factors as obtained in the present investigations are as follows :—

Relative potencies of the several preparations as determined by the chemical and biological tests and the product of both the values

TABLE X

Nature of Preparation	Relative recoveries by chemical estimation		L. D. 50	Product of chemical recovery value and L. D. 50	
	Washing	Shaking		Washing	Shaking
(1)	(2)	(3)	(4)	(5)	(6)
Benzene emulsion on glass ...	1·50	1·17	1·00	1·50	1·17
Benzene emulsion on leaf ...	1·02	1 06	1·62	1·65	1·72
Dekalin emulsion on leaf ...	1·00	1·00	1·88	1·88	1·88

Examining statistically the above results (Table VIII) we have :

Comparison	Regression lines are :-	P	L. D. 50%
Benzene emulsion on glass	$Y = 2·582 \times + 1·109$	1·2 — 0·1	0·0321 *(0·0329)
Benzene emulsion on leaf	$Y = 3·675 \times - 1·323$	> 0·9	0·0526 *(0 0525)
Dekalin emulsion on leaf	$Y = 4·938 \times - 3·748$	0·2 — 0·1	0·0591 *(0·0610)

*These are the values actually obtained from the chart by plotting probits against log. concentration.

The difference in slope and position when tested gave :—

Treatment compared	χ^2_a	P	χ^2_b	P
Benzene emulsion on leaf / Dekalin emulsion on leaf	4.735	0 05 — 0·02*	4·291	0·05 — 0·02*
Benzene emulsion on glass / Benzene emulsion on leaf	27·630	< 0·001*	5·548	0·02 — 0·01*
Benzene emulsion on glass / Dekalin emulsion on leaf	42·690	< 0·001*	17·710	< 0·001*

* Significant.

All the lines therefore, differ in the slope and position which suggest that an estimate of their relative potencies is not possible. The line for dekalin cuts the benzene line, which indicates that the reactions of the deposits are different. The results for benzene and dekalin emulsion differ significantly though not widely (1 : 1·12). Also, it is evident that the deposit on glass is significantly more toxic than that for the same emulsion on leaf.

Discussion: Reviewing the foregoing results it is seen that the nature of the surface and the mode of deposition have great influence on the toxicity of the insecticide. Absorption of the insecticide by the leaf surface both by chemical and biological tests has been established. This absorption is maximum following deposition as a solution and least from a suspension. Comparing similar preparations on glass and leaf, the recoveries from leaf are roughly two-thirds (66%) of the original amount deposited, and their relative performances as revealed by L. D. 50's are inversely proportional to the percentage recoveries obtained by washing procedure. The nature of the solvent used in the preparation of the emulsion can influence toxicity to some extent. A solvent with high boiling point like dekalin gives a less toxic deposit than one prepared by using benzene which has a low boiling point. Broadly speaking, the chemical recoveries are in agreement with theoretical considerations, and it would also appear that they might enable one to predict their insecticidal performance. For example if one finds by analysis that there is a surface concentration of 10 micrograms of DDT per sq. cm., 100% kill of an insect like *Tribolium* which is killed by contact action is certain. Conversely, if a deposit gives a kill of 100% with *Tribolium* in a period of six days the surface concentration of the insecticide may be assumed to be 10 micrograms per sq. cm. and over.

When examined statistically some results were found to be significant and some not. Making due allowance for the limitations placed on biological tests, it was however found that all results obtained were in agreement with theoretical considerations. Different preparations showed different toxicities, but whether their slopes are strictly parallel or not, and whether any strict comparison could be made will have to be decided by conducting further work with a variety of preparations and

insects. The tests conducted in the present investigations were confined to *Tribolium* which is killed by contact action. Under such conditions a preparation made with a solvent having a high boiling point is less toxic than one made with a solvent having a low boiling point. The same preparations, however, when used in the case of caterpillars which are killed by stomack poisoning action also may give different results.

Summary: Comparing the relative merits of recovering DDT when deposited in various forms by washing and shaking techniques it was found that mere superficial washing was enough to remove all the insecticidally useful portion. The recoveries effected by such a method seem to be related to the results obtained in the biological tests but in an inverse proportion. The nature of the solvent used in the preparation of the insecticide and the nature of the surface on which the insecticide is tested largely influence the insecticidal value of deposits.

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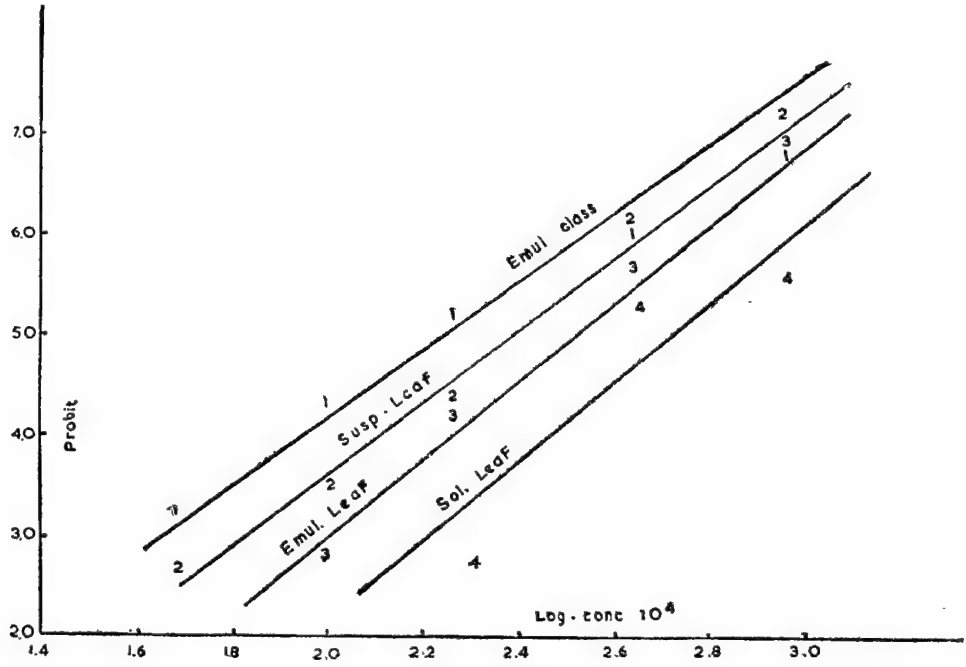

CHART I

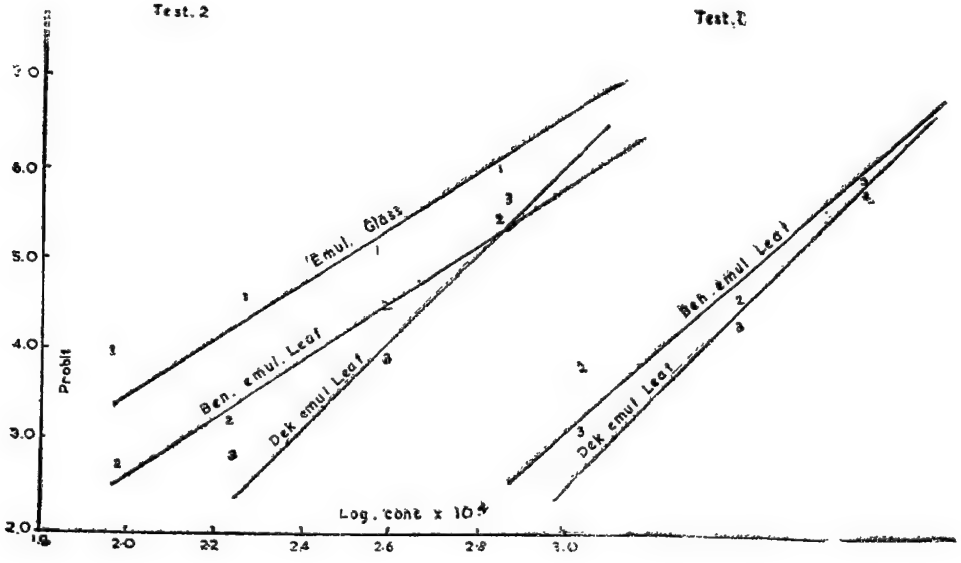

CHART II

An Economic Survey of the Production and Marketing of Mangoes in Visakhapatnam District

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Introduction: Mango is eaten in forms, various from the fruitlet to the finished product, the points in its favour being its availability in seasons, an appetizing flavour, pleasing bouquet, luscious bulk and a high dietetic value as a source of vitamins. Yet its production is not commensurate with the demand and its importance and there seem to be no marked improvements in cultural practices and marketing methods. The existence of pre-harvest contractors in the place of growers, numerous intermediaries in marketing, imperfect merchandising, absence of market associations and the trade's dependence on external demand are the major problems that require consideration. Further, the low production from mango orchards in recent years points to lack of sufficient interest on the part of the growers.

Material and Methods: An investigation was conducted on the lines of the Central Agricultural Marketing Reports during a tour in the Circars in May 1949, and was supplemented by enquiries in subsequent years. Wherever possible official information is supplemented with local enquiries. The scope of introducing better methods of production and systematised market practices is examined, with relevant recommendations.

State Production and Trade: Mango is grown on an area of 2,50,000 acres, forming roughly 50% of the total extent under fruits in the Madras State. Its annual production is estimated at 8,00,000 tons, of which 2,000 tons are exported to other States in India. In recent years there is a downward trend of exports, due to various factors, the chief among them being inadequate wagon supply.

District Supplies: (a) *Acreage and its trends*: This district had an area of 36,140 acres in 1948–'49 (normal area 29,400 acres) being 14·58% of the total area under this crop, taking a second place in the State. The acreage shows a gradual increase upto 1935–'36, with a maximum of 46,575 in 1926–'27 and thereafter a decrease, reaching a minimum of 26,830 acres in 1938–'39. The former is attributable to the liberal assignment of porambokes at low rates during the early years, while the latter points to the wide destruction of aged orchards in later years. During the quinquennial period ending with 1938–'39, gardens on about 14,500 acres (35% of the average area) were removed and renovated with choice

varieties to an extent of 11,8000 acres (80% of the destroyed area). The climate and the red loamy soils of the tract are best suited for its extensive cultivation.

(b) *Propagation, classification and description of varieties:* In this district mango industry is chiefly in the hands of *Kshatrias:* who are tradionaly the pioneers in the trade and are responsible for the introduction and spread of a large number of choice varieties.

Among the varieties Swarnarekha leads with 50% followed by Banganapalli, Collector and Kolankagoa, each 10%, besides other types occupying 20%. According to the Marketing Report the first two occupy 40% and 20% of the area cultivated during the years 1935–'36 and 1936–'37. Of the area cultivated, about 20% is estimated to be under seedlings.

The varieties are classified locally according to the month of harvest, the normal season being April to June–July.

	Class	Variety	Period of harvest.	
			Month.	No. of days.
1.	Early	... Rajamanu, Chilakalamanu, Panikalamanu, Firangiladhva, and Parava ...	April	15
2.	Mid	... Panchadarlakalasa, Cherukurasam, Nalla Andrews, Sannakulu, Swarnarekha, Banganapalli, Goa varieties and Baramasia	May–June	50
3.	Late	... Kolankagoa, Collector, & Neelum ...	June–July	25

Of the above varieties not all are of commercial importance while those that claim inter-State recognition are very few, the chief among them being Swarnarekha and Banganapalli, which form about 65% of the trade in Visakhapatnam district.

The characteristics of the commercial varieties classed on the basis of size are detailed below:—

I *Large Fruits:* (Weighing 12 to 16 ounces and over)

SWARNAREKHA: Yellowish orange, flushed with crimson colour–oval shape–soft fruit–pleasant flavour and sweet taste early season and fairly regular and heavy yielder–a table and juicy variety of poor keeping quality.

BANGANAPALLI: Lemon yellow colour–long or bulged shape–hard fruit, pleasant flavour and sweet taste–mid season and moderately regular, heavy yielder–table variety–good keeping quality.

COLLECTOR: Lemon yellow to yellowish orange colour – rectangular or slightly reniform shape with curved beaks – ripens unevenly – aromatic flavour and taste varying from sour to sweet – mid to late season and moderately heavy yielder table variety and keeping quality good to medium.

II *Medium Fruits:* (Weighing 6 to 12 ounces)

NEELUM: Orange yellow colour – oval or slightly reniform shape with curved beaks – moderately hard fruit – pleasant flavour and sweet taste – late and off-season and moderately regular, heavy yielder – table variety and good keeping quality.

KOLANKAGOA: Light yellow colour – oval, with a rounded and slighly extended base – hard fruit – delicate, aromatic flavour and moderately sweet taste – late to mid season and heavy yielder – table and pickle variety – keeping quality medium-

III *Small Fruits:* (Weighing 6 ounces and less)

RAJAMANU: Lemon yellow colour – oblong and slightly reniform shape – soft fruit with abundant juice – pleasant flavour and medium sweet taste – early good yielder – juicy variety – keeping quality medium to poor.

(c) *Production:* Graft mango gardens commence bearing at the age of 5 years and attain full bearing capacity from the 10th year tending to decline after 20 years and cease to bear after 40 years. There are however plantations as old as 80 years but usually 40 to 50 year-old groves are uneconomical. Naturally the limits fixed vary according to variety, soil and climatic conditions, culture of the groves etc.

The distribution of groves according to the bearing periods as observed in Visakhapatnam district is as follows:

Orchard stage	Bearing period in years	Area in acres.	% to the total	Estimated per tree No. of fruits	Normal yields per acre Imperial maunds
1. Young	... 5 & below	11,793	32·7	No yields.	
2. Bearing:					
a. Early	... 6 to 9	7·190	19 9	80	28
b. Prime	... 10 to 20	4.279	22·1	200	70
c. Old	... 21 to 25	3,730		150	52
d. Aged	... Over 25	9,060	25·4	100	?
Total for the district.		36,140	100·0	Average.	46·25

In the absence of performance records it is difficult to assess the yields with any accuracy.

In general a ten-year old tree bears 300 to 500 fruits in years of heavy bearing and frequently mature trees 1,000 to 1,500 fruits, but the average over a period of years would seldom approach

that figure. The average calculated over the bearing period as revealed by the present enquiry works out to 135 fruits per tree per year, with an annual production of 37,280 tons in this district. This estimate nearly agrees with that of Balakrishnamurthy and Jogiraju, who put the average at 100 fruits per tree in a year and that of a fairly good crop at 200 to 300. According to the Marketing Report the same is estimated at 146,887 tons i.e. 4 tons per acre or about 320 fruits per tree. Since non-bearing orchards constitute nearly a third of the area, this estimate seems to be rather high. The decline in yields in recent years is attributed partly due to the harvest of immature fruits to meet the increasing demand for exports.

(d) *Trade :* The producing areas distributed all over the districts form a natural grouping into four primary zones :— Alamanda, Anakapalli, Narasapatam and Vizianagaram. These zones are also principal exporting markets as almost all the produce reaches the market from the neighbouring places of production,there being no major exporting centres in Srikakulam district (formerly North Visakhapatnam) since the supply caters mostly to local demand.

The following table shows the flow and periodicity of supplies in a year. The peak period is May – June and the slack months are April and June – July, the length of the season being taken as 90 days.

Production and exporting centre	Seasonal production Daily estimated average in imp. maunds			Remark.
	Peak	Slack	Total	
a. Alamanda ...	2,000	1,000	3,000	Of this quantity 75 to 80% is available for export to other States and therest is utilised for home consumption 18 to 15% as fruit (including pickle) and the remaining for dehydrated pulp *(Thandra)*
b. Anakapalli ...	1,800	700	2,500	
c. Narasapatam ...	1,000	500	1,550	
d, Vizianagaram ...	300	200	500	
e. Other producting areas. ...	1,500	500	2,008	
Total ...	6,600	2,900	9,500	

Noxe :— The consuming centres outside the State where the produce finds market are :-

Calcutta, Kharagpur, Midnapur and Asansol in West Bengal; Delhi; Amritsar in Punjab (Ind.), Lahore in Punjab (Pak.); Berhampur, Cuttack, Puri, Badrak, Balasore and Sambalpur in Orissa; Tatanagar, Chekdharpur, Ranchi and Ramghar Town in Behar; Raipur, Nagpur, Katni, Bilaspur in Madhya Pradesh, and Hyderabad (Deccan).

The seasonal fluctuations, however, affect the flow of supplies. Damage due to mango hoppers, wind and hail storms is quite considerable, amounting upto 80%, depending on the intensity of the attack.

Demand: The demand for mangoes is universal from all classes of people. The home consumption in this district for an average family may be approximately 100 to 150 fruits as pickles, and about 150 to 290 fruits as fruit for the season and the per capita consumption may be about 25 to 50 fruits every year. Of course this varies very widely according to the individual purchasing power, depending on the prevailing price in the season. The demand for pickle variety is more during the months of April – May, while for dehydrated pulp it extends all over the season, damaged fruits and rejects being mostly used for that purpose. The total home consumption in the district is approximately 20,000 tons a year on the basis of population with due allowance for infants, invalids and the extremely poor.

The external demand is heaviest in the months of May – June, though it starts from April and extends to even July. Raw mangoes (fruitlets) are also in demand during January – February and dehydrated pulp during August to October. Exports to meet the demand from other States are effected to a large extent, while internal demand suffers in years of low production. From the seemingly inelastic demand, it would appear that the grower could dominate the trade, but actually he does not.

Prices: (a) *General:* No official publication of the prices in the different markets is available. Recently the Monthly Digest of Economics and Statistics of the Madras State started in 1950 gives the wholesale prices for the markets in the State and for this district the prices at Vizianagaram market are reported. In the absence of regular accounts of the grower's business and with the available scanty records maintained by the contractors and traders no easy appraisal of the prices or their annual and seasonal fluctuations is possible.

(b) *Orchard prices of standing crops:* Much speculation arises in fixing these prices and the contractors generally take into consideration the following factors:—

(i) Age and production capacity of the orchard,

(ii) Extent of flowering or bearing in the season,

(iii) Location of the orchard, availability of cheap labour and facilities for transport and marketing,

(iv) Expenditure for watch from sale to picking, and

(v) Extent of competition among the contractors.

The prices vary from Rs. 70 to 100 per acre depending on the condition of the orchards. The range in prices from year to year is more less influenced by the seasonal factor and the performance of the groves, it being anything from 5 to 10%.

(c) *Wholesale prices:* Since these prices are determined on the basis of available supplies and the external demand, the internal market has the least influence. As such the market rate in the producing areas is ruled by the merchants of other States and commission agents. Since the marketable produce is a perishable commodity dependent on the customary external market, the wholesale price has not much relationship to the production of the season though it is observed that prices tend to be high in years of low bearing. The main factors influencing the wholesale price are therefore :—

(i) External demand, (ii) early supply in the market and (iii) variety or quality of the produce.

The general behaviour of prices remain almost the same between years, though fluctuation is observed during a season. The current wholesale prices for the different commercial varieties are given in the following table:—

Variety	Wholesale rate per 1000 in the season			Remarks.
	April-May	May-June	June-July	
	Rs.	Rs.	Rs.	
a. Neelum ...	...	30	25	1,125 fruits are counted for
b. Kolankagoa ...	...	40	30	1,000 to allow for the damaged
c. Collector ...	...	60	50	and unripe ones.
d. Swarnarekha ...	70	65	...	
e. Banganapalli ...	100-80	...	...	

Note: The market for a season opens with a high price when the supplies just commence, shows a downward trend during the progress of the period when the market is in full swing being flooded with most choice varieties and tends to rise towards the close of the season with the few late types.

The variety-war fluctuations and weekly trends of the wholesale prices in a season during the three years 1944 – '46 are studied. (Vide appendix). Variation in the different markets for the same kind and quality in a year is influenced by the following factors :—

(i) Available supplies and demand,

(ii) Location of the exporting market,

(iii) Transport facilities (both by road and rail), and

(iv) Market charges etc.

(d) *Retail prices:* The retail price is influenced by the wholesale rate prevailing at the place of production. The fruits are sold by the retailers on the basis of number, and the rate paid by the consumer varies considerably.

(e) *Market intelligence :* The growers are out of the picture and the contractors are indifferent about the customers' requirements, while the commission agents or the exporters form the link between them and the merchants of the other States. Merchants from other States or their agents come and reside at the market place during the season doing business through commission agents. The representatives are advised either by wire or letter intimating their local market rates and demand. Based on such instructions, exports are effected. There is no other means of disseminating market news to the growers or contractors. This naturally leads to much exploitation by the outside merchants and warrants better organisation.

Preparation for the market, grading and standardisation : No grading or standardisation is adopted save that of hand grading according to the size and variety, rejecting the damaged ones. Variety forms a natural basis for quality grading in mango. Limiting the varietal variations in mango by propagational methods serves the purpose of standardising the quality. This being important to growers as well as consumers, the wholesalers are usually influenced by the following features in selecting their fruit for their consignments :—

(a) External appearance : Stage of maturity, colour, size, shape, freedom from surface blemishes and mechanical injury.

(b) Fruit quality : Abundance of pulp, free from fibre, good flavour and taste.

Processing is not practised except ripening the fruit by packing the produce loose in bamboo baskets with a lining of straw. Tissue wrapping and packing the fruit in wooden ventilated crates of 2′ x 1′ x 1′ with a lining of soft material such as grass, straw etc., is desirable and economical as the losses on account of packing in bamboo baskets is as high as 15%. The boxes may be made returnable to save packing and forwarding charges.

Assembling and distribution : A number of intermediaries are engaged In assembling the produce to the distributing market consisting of various categories with numerous functions. The methods involved are as follows :—

(i) Growers sell their standing crop during January to March to pre-harvest contractors because of the difficulty in marketing and also of the unwillingness to take up the risks involved. It is a forward contract and the transaction is settled on payment of an advance ranging from 10 to 50% of the lease value as mutually agreed upon, watch, harvest and handling charge being borne by the contractors which amount to Rs. 45 per acre (Re. 1—0—0 to 1—4—0 per imperial maund).

(ii) Contractors take the place of growers and undertake supply of the produce to commission agents or exporters.

(iii) Commission agents purchase fruits from either contractors or growers.

(iv) Market organisations : Private Fruit Growers' Association and Fruit Merchants' Association (Registered) both of which are now not functioning properly.

The agencies and the methods of distribution are as under :—

(a) The fruits pass several hands before actually reaching the consumer.

(b) Growers do not undertake distribution usually. Of late some are engaged in doing their own business acting as exporters.

(c) Contractors form an important link supplying the fruit and receive advances from commission agents and also do retailing.

(d) Commission agents take up the essential function — the wholesale distribution of the produce. Retailing is done to a certain extent.

(e) Agents or representatives of merchants of other States reside at the place of production in the season and advice exporters regarding their requirements. The exporters despatch consignments and bill the packing and forwarding charges, besides freight and incidentals.

(f) Retail distribution is done by stall holders, hawkers and street vendors (usually contractor's family members) selling the fruit by roadsides or from door to door.

Market charges : Thatched sheds of 10' x 10' costing about Rs. 150, with a third of the value being realised at the close of the season, forms the main place of transacting the business. *Kalasis* (regular labour) on monthly basis at Rs. 30 to 50 are engaged for the season (3 months) depending on the skill and experience of the person. For a daily average exportable business exceeding two wagon-loods eight *kalasis* are engaged. Some *kalasis* work on daily basis at rates ranging from Rs. 1—8—0 to 2—0—0 ; these are mostly extra hands doing piece-work and find employment when there is heavy rush of fruit in the market.

The fruits received at the market-place through the different agencies are purchased and sold according to quality and size and paid for at the prevailing market rate. Open sale by sample and price fixation by mutual negotiation on satisfaction of the sample are usual ; the fruit being supplied on confirmation of the rate.

Exporters or commission agents receive remuneration for purchase, packing and forwarding, the commission varying from As. 6 to 8 per maund of the consignment. In the case of those who do their own business of forwarding etc., the commission paid to the merchant at the other end ranges from As. 10 to 12 per maund of the imported fruit.

Market tolls at the rate of one anna per maund and As. 6 per cart load (20 to 25 maunds) for produce received from outside the panchayat or municipal limits are collected. Handling, transport and forwarding charges on the basis of equal expenses are collected along with the value of the produce, which work out to roughly As. 12 per maund besides other miscllaneous charges like *mamools*, etc.

Tho spread of prices and the allocation of the consumer's rupee among the various agencies including the grower is as given below :—

Agencies at the different stages.	Share of the consumer's rupee.
I. Production Centre :–	
Orchard owner	0–7–0
Orchard purchaser (Contractor) ...	0–1–0
II. Export Centre :–	
Incidentals including, packing, freight etc.,	0–3–6
Commission to the exporter ...	0–1–0
III. Importing or Consuming Centre :–	
Incidental charges	0–0–9
Middlemen or Commission agent ...	0–0–9
Margin to the merchant of the other State	0–2–6
Total ...	1–0–0

Handling and Transport: Under the existing methods of handling the fruits are liable to injury at every stage in the process of marketing, although fruits are picked with care, using poles with ring-nets to prevent damage.

On the basis of distance traversed and the mode of conveyance used (headloads, *kavidis* and carts) the charges incurred on an average work out to As. 1 to 2 per mile per maund subject to a maximum of As. 3 to 6 irrespective of lead and the mode of transport.

Ordinarily carts drawn by men are used for moving the produce to the railway station and lorries to places outside the district and to neighbouring railway stations; to get over the booking restrictions when there is rush of exports and difficulty or competition in the timely supply of wagons at the place of export. Fresh fruits are classified under railway risk and owner's risk for despatch by goods in wagon loads under Class 3 and 2 respectively

and charged at different rates. In the case of consignments for despatch per parcel trains the goods are charged at quarter parcel-rates.

The mango baskets, about 250 maunds are loaded in layers one over the other within the space of the wagon (wagon capacity 17 to 22 tons), so much so the bottom layers get the entire pressure of the consignment and the fruits get subjected to considerabls damage. It is therefore suggested that the wagons might be designed with racks inside having a clearance space of 4' with a width 3' on the sides and provided with air-conditioning if possible.

Storage and preservation : As the produce finds immediate disposal no arrangements are needed for storage except protecting the fruit in transit and at exporting markets from the severity of the sun as instances are not uncommon of consignments awaiting clearance at railway stations and market places for about a week. Cold storage as a means of long distance exports were tried in Bombay but none of the varieties in this tract stand cold storage satisfactorily, because of chilling effects at low temperature.

Summary and Conclusions : A discussion of the factors affecting the production and marketing of the mango in Visakhapatnam district reveals the importance of its culture as the premier marketable commodity under fruits.

The total area in the district is 36,140 acres which is 14·58% of the total area in the State, with an annual production of 37,280 tons. The producing areas form a natural grouping into four primary zones, which are also incidentally the principal exporting markets. Of the consuming centres outside the State, Calcutta forms the chief market for Vizag produce closely followed by Nagpur. The annual exports to other States amount to roughly 28,000 tons. Of the chief commercial varieties Swarnarekha and Banganapalli form the bulk of the trade.

The estimated home consumption is about 20,000 tons with a per capita of 20 to 50 fruits a year. There is a steady demand from North India for raw mangoes (fruitlets) during January – February, ripe fruits in May – June and for dehydrated mango pulp (*thandra*) between August to October.

There is at present no proper agency to spread market intelligence among the producers and traders. The prices in the producing areas are fixed and ruled mostly by the merchants of other States and the local businessmen are at their mercy.

In the process of assembling and distribution of the produce, the producers play a less significant role, there being a number of intermediaries. The producer's share in the consumer's price is

only seven annas in a rupee. Financial help to contractors and exporters narrows the limit of competition among buyers and ultimately affects the producers' price. The methods and costs of transport (both by road and rail) show certain inherent difficulties and limitations by way of booking restrictions, inadequate wagon supply, unsuitability of the present steel wagons, spoilage in handling etc. Absence of unequivocal methods to fix the proper stage of maturity for picking, imperfect ripening methods and crude methods of packing lead to much damage and pilfering in transit.

Recommendations: There is scope for improvements in the mango industry and trade on the following lines :—

(i) Replacement of seedling-propagated, uneconomic and aged gardens by grafts of known performance and commercial importance.

(ii) Improving yields by proper cultural practices to promote regular bearing, besides taking timely precautions to prevent damage due to pests and diseases.

(iii) Exploring new external markets for exports.

(iv) Maintenance of performance records for individual orchards.

(v) Stabilisation of prices may be aimed at by :—

  (a) Fixing ceiling and floor prices for the commodity.

  (b) Organising a bureau of market intelligence for disseminating market news to traders.

  (c) Inducing growers to organize a multipurpose co-operative society so as to eliminate the disproportionate margins of the intermediaries.

(vi) Establishing regulated markets and licencing the traders in order to ensure controlled and systematised marketing.

(vii) Improving the quality by proper selection of varieties, and adopting grade specifications and standardisation of containers and packing, notifying the number and weight of fruits in the containers, for each variety as a grade standard.

(viii) Minimising the damage and losses in transit by introducing returnable, well–ventilated crates in the place of the crude bamboo baskets, and by improving the design and type of the wagon by providing shelves to release pressure due to basket piles, and air-conditioning to regulate inside temperature.

(ix) Utilisation of the unexportable or surplus fruits by establishing small-scale canning units in the main producing centres.

(x) Scope for investigation and improvement of the dehydrated pulp industry; as at present it is in its crudest form.

(xi) Evolving new types that give more regular and earlier yields.

(xii) Research to increase the bearing capacity in off-season varieties.

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APPENDIX

Statement showing the price trends in a season for the important commercial varieties of mango in the tract for three years

Variety	Year.	Average price (wholesale) per 1000 fruits in rupees, Weeks in the months of											
		April				May				June			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
Swarnarekha	1944	68	55	44	35	29	...	...	...	...	...	...	...
	1945	...	...	...	...	...	...	45	...	.	...	...	
	1946	100	100	62	...	45	56	55	...	...	...	...	
Banganapalli	1944	...	...	39	32	30	...	...	...	...	...	...	
	1945	...	...	...	...	...	...	58	...	...	...	...	
	1946	...	...	...	...	...	55	57	...	...	...	...	
Kolankagoa	1944	...	...	...	...	19	...	...	...	...	...	...	
	1945	...	...	...	...	...	...	46	...	...	...	...	
	1946	...	...	...	...	...	43	...	...	...	...	...	
Collector	1944	...	...	30	22	21	...	...	...	...	...	...	
	1945	...	...	...	...	...	...	45	...	...	...	...	
	1946	...	...	...	...	...	41	44	49	...	...	...	
Miscellaneous varieties.	1944	...	...	...	...	...	20	...	...	...	...	...	
	1945	...	...	...	...	...	...	42	...	...	...	...	
	1946	41	43	...	...	40	...	...	...	...	...	...	

(Collected from the records of the exporters.)

Note on a New Type of Quick-Yielding Jack Tree

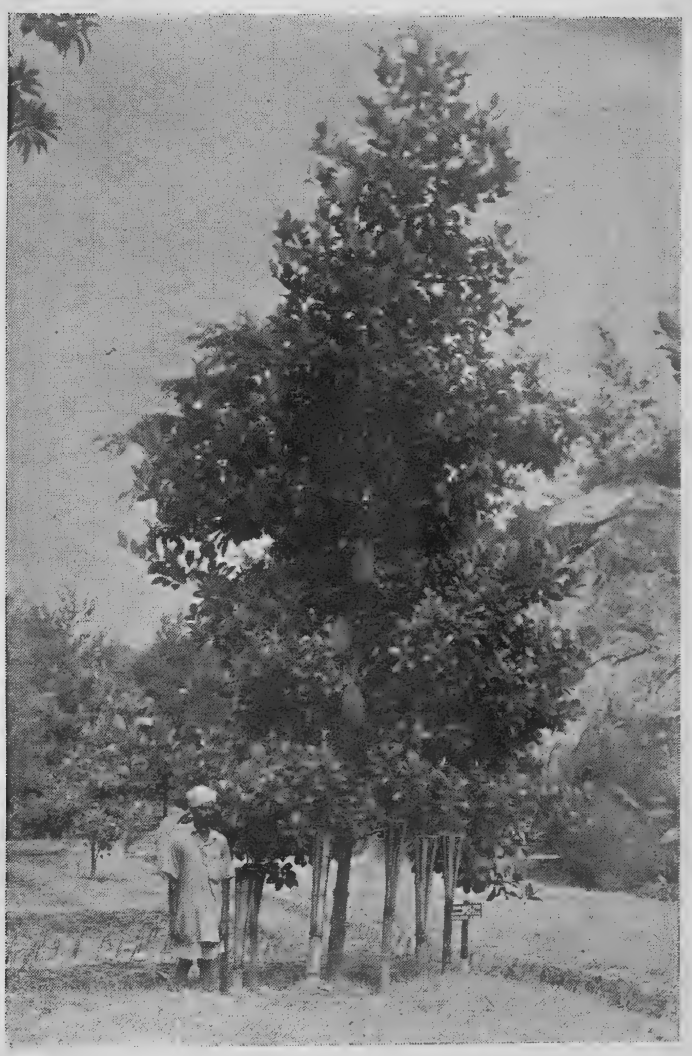
Jack and its uses: Jack is a favourite fruit of South India, with many varied uses in Indian households. The fruits, including seed, form a well-known article of food particularly in the West Coast. The dark-green leathery leaves are sewn together and used as dining plates by the poorer classes; they are also used for wrapping certain cereal preparations in the course of baking or cooking. The fruits have been also used for preparing excellent candies, sherbeths, conserves and other forms of preserved fruit. The wood is highly valued as timber. The trees being tall and ever-green, are often grown as avenue trees and are preferred as shade for coffee and other plantation crops.

A poor man's food: In producing large-sized individual fruits, jack has the pride of place among the several cultivated fruits of the world. Instances where individual fruits have weighed more than 100 lb. each are not wanting. On account of this exceptionally large crop weight per tree, the jack tree can rank foremost among South Indian fruits in the total quantity of food produced per acre. In respect of total annual production it comes next to the mango and banana, with more than one lakh of trees spread over different tracts of South India. No wonder it is often referred to as the "poor man's food".

One of the hardiest of fruit-trees : Jack is an ever-green and is considered one of the hardiest of cultivated fruit-trees. It is not very exacting in its soil or cultural requirements. It thrives well in semi-dry to moist tracts up to elevations of about 4,000 feet. The seedling trees usually take a long time, nearly seven to eight years, to commence fruiting. Precocious types in such fruit trees, therefore, are considered very valuable and are always eagerly sought after by growers.

A new precocious type *("Singapore" or "Ceylon" Jack)*: A search for such early maturing types resulted in the introduction (at the instance of Sri M. S. Sivaraman, Director of Agriculture, Madras) of the "Singapore" or "Ceylon" jack variety reputed for its early bearing, within 18 to 24 months after planting in its naturalised home Ceylon. Seedlings raised from seed obtained through the courtesy of the Horticultural Officer, Peradeniya, Ceylon, were planted in December 1947 at the Government Fruit Station, Kallar (1,400 feet above M. S. L.) situated at the foot of the Nilgiris in Madras State. This tract possess a warm, humid climate with an annual average rainfall of about 55 inches and a temperature range between 100°F and 60°F. The soil is of the type of light red loam of varying depths and is well drained.

The plants in the beginning appeared to make somewhat slow progress in the process of acclimatisation, but from the second year onwards began to make vigorous vegetative growth. By the end



"SINGAPORE JACK" in bearing

Planted in December 1947. Flowered in December 1950 and fruited.

of June 1951 (42 months after planting) the trees had attained an average size of 13½ inches in girth and nearly 16 feet in height and 7 feet in spread. One tree in particular was the most vigorous of all and measured two feet in girth and 25½ feet and 13 feet in height and spread. The detailed growth measurements are recorded below :—

Growth measurements of "Singapore" jack trees at Kallar Fruit Station in the Nilgiris, planted in December, 1947)

(Measurements made in June 1951)

Tree No.	Height, in feet	Spread in feet.	Girth in inches	Remarks.
(1)	(2)	(3)	(4)	(5)
1	12·0	7·0	10·0	
2	12·0	7·0	12·0	
3	18·5	6·0	15·0	
4	11·0	8·0	10·0	
5	25·5	13·0	24·0	Flowered in December '50 and the flowers shed. Registered maximum growth.
6	13·0	6·0	10·0	Flowered in December '50 and August '51 and the flowers shed.
7	24·0	7·0	19·0	Flowered in December '50 and fruits matured July – August '51
8	16·0	10·0	13·0	Flowered in December '50 and August '51 and the flowers shed.
9	19·0	7·0	15·0	
10	15 0	6·0	13·0	
11	14·0	5·0	11·0	
12	17·0	5·0	10·0	
Mean	16·9	7·3	13·5	

Early bearing: *(Description of the fruit and tree):* Out of four trees that blossomed in December 1950, one ultimately set three medium-sized fruits which developed normally and came to harvest in July – August 1951 after 42 months of orchard life.

A brief description of the fruit and the results of "sampling tests" are furnished below :—

(1) *Average weight and size of fruit:* 15 lb., medium.

(2) *Shape:* Oval and cylindrical.

(3) *Nature of rind:* Moderately thick, greenish with yellow patches when mature.

(4) *Surface:* Uniform without many undulations, spines sharp and thickly set.

(5) *Weight of edible flesh:* 6·75 lb.

(6) *Weight and nature of core:* 1½ lb. short and wide at the centre.

(7) *Taste, flavour, texture, etc. of flesh:* Sweet, crisp with fairly strong aroma, carpels compactly arranged, glossy, yellow and firm.

(8) *Number of seeds:* 80 to 90, filled in almost all the segments.

(9) *Size and shape of seeds:* Medium, oval.

(10) *General remarks (on quality, nature of bearing, etc.):* A good desert type, fruits mostly borne on the upper portions of the trunk. The time taken between complete maturity (as denoted by pressure test, colour changes and smell) and ripening of the fruits was observed to be very short, all the fruits becoming fit for consumption within about 12 to 15 hours of harvest.

In their original habitat the seedling trees of this jack (which is believed to be a variety of *Artocarpus integer*) are reported to come to bearing in about 18 months in low country and about 24 months on the hills. They are known to produce both hard and soft-fleshed fruits, the former particularly being highly esteemed for cooking in immature stage.

Under Kallar conditions the fruits have proved to be a good dessert quality, as good as any other local jack, although they are likely to be rather under-sized when compared with the latter. The trees have exhibited a very rapid rate of growth. In other morphological characters, these trees are hardly distinguishable from ordinary jack except for their slightly smaller-sized leaves which are less leathery and of paler green colour than those of the latter.

A promising type for future extension: The remarkably precocious tendency exhibited by the trees even under local conditions (where they have fruited within three to three and half years of planting) combined with the good dessert quality of the fruit marks this type as a promising one, meriting further extension in all such tracts as are suitable for it.

Fruit Section,
Coonoor and Kallar.

V. S. RANGACHARLU
and
K. SAMBASIVA RAO,

GLEANINGS

New Synthetic Rubber: A new synthetic rubber, superior for certain uses to both natural rubber and other synthetic rubbers, has been developed by the U. S. Department of Agriculture.

This new rubber, known as Lactoprene BN, has outstanding resistance to dry heat, water, oils, below-zero temperatures, and ageing. It is expected to excel natural rubber and other synthetic rubbers for such uses as oil seals in automobile transmissions, refrigerant seals, gaskets, and linings for fuel tanks.

The improved rubber is made from compounds which can be produced from milk or corn sugars. The rubber's composition can be changed by varying the proportions of the chemical ingredients. *[Agricultural Situation, U. S. D. A., June 1951]*

Did you know?

India grows 75 per cent of the world's supply of sandalwood. The annual export of the wood amounts to 800 tons and of sandal oil to about 1,00,000 lbs. valued at Rs. 25 lakhs and Rs. 40 lakhs respectively.

Over Rs. 1/- crore worth of foodgrains and fodder were saved in 1950—1951 from the ravages of grasshoppers by control measures taken against them.

From 8 lakh tons in 1945—1946, the annual production of compost in India has risen to 56 lakh tons in 1949—1950.

Next to the U. S. A., India is the largest cotton producing country in the world.

A little over 43 per cent of India's total milk production is converted into ghee.

India increased her food production by approximately 14 lakh tons, cotton by about 3 lakh bales, jute by 2 lakh bales and sugar by 1,25,000 tons in 1950—1951.

Of about 3·2 million acres under the improved varieties of sugarcane in India, 2 million acres are in Uttar Pradesh.

India requires about 1,50,000 tons of coconut oil a year for industrial and other purposes.

India has about 37·7 million sheep which yield 76 million pounds of wool per annum.

There are 25 types of pedigree bulls in India of which the original home of 3 types is in Pakistan.

Of a total revenue of over Rs. 85 lakhs from the Andamans in 1949—1950, about 82 per cent came from the forests.

India produces about 12 million bamboos a year, half of which are used for agricultural purposes and other half for making paper, house-building, fencing, poles etc.

Out of a total area of 13 million acres under cotton in India in 1950—1951 about 47·7 per cent is under improved varieties. These brought in an additional income of Rs. 5/- crores to the growers. *(The Farmer, August 1951).*

Statistics — Third or Final Forecast Report — 1. Crop - Cholam : The area sown with cholam (*Jonna* or *Sorghum vulgare*) in 1950—'51 is estimated at 4,640,600 acres. Compared with the final area of 4,749,508 acres for the previous year this is a decrease of 2·3 percent. The area estimated for this year is higher than the average area during the five years 1944–'45 to 1948–'49 viz., 4,462,200 acres by 4·0 percent. Cholam is not grown in South Kanara and the Nilgiris districts and is grown only to an insignificant extent in Malabar and Tanjore districts. Compared with the final area for 1949 – 50, the present estimate reveals a decrease in Kurnool, Bellary Anantapur, the Carnatic and the Central districts Madurai and Ramanathapuram, districts and an increase in the other districts of the State except Tanjore where the area is expected to be the same as that of last year. The decrease in area is marked in Bellary (—39,500 acres) Anantapur (—20,100 acres), North Arcot (—10,900 acres), Coimbatore (—11,000 acres) and Madurai (12,700 acres).

The main crop has been harvested in most districts of the State. The yield per acre is expected to be below the normal in all the districts of the State, especially in Srikakulam, Visakhapatnam, Cuddapah, Chingleput, North Arcot, Coimbatore, Ramanathapuram and Tirunelveli, due to the continued failure of the North-East Monsoon rains. The seasonal factor for the State as a whole works out to 64 percent of the average as against 81 percent in the Season and Crop Report of the previous year. The total yield for this year is estimated at 991,400 tons of unhusked grain or 842, 700 tons of cleaned grain. This represents a decrease of 10·6 percent, compared with the yield of 1,109,200 tons of unhusked grain or 942,800 tons of cleaned grain acrording to the Season and Crop Report for the previous year. The average yield during the previous five years (1944—'45 to 1948—'49) is estimated at 1,014,000 tons of unhusked grain or 861,900 tons of cleaned grain. The average wholesale price of cholam per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from some of the important market centres on 17th March 1951 was Rs. 8—1—0 in Guntur, Rs. 9—1—0 in Rajahmundry and Rs. 10—15—0 in Cuddapah.

2. **Cumbu** *(Bajra ; Pennisetum typhoides) :* The area sown with cumbu in the Madras State during 1950—'51 is estimated at 2,231,400 acres. Compared with the final area of 2,349.800 acres in the previous yaer this is a decrease of 5·0 percent. The estimated area in the current year is lower than the average area during the the five years ending 1948—'49 viz by 2,344,800 acres or 4·8 percent. 210,400 acres have been reported as sown under the crop since the second forecast report was issued. Cumbu is not grown in the West Coastal and the Nilgiris district. An increase in area over that in previous year is estimated in the districts of Srikakulam, Visakhapatnam, Guntur and Cuddapah and a decrease in the other districts of the State. The variations are marked in Anantapur (–14,000 acres), South Arcot (–15,300 acres), Chittoor (–18,800 acres), North Arcot, (–16,300 acres), Salem (–14,200 acres) and Coimbatore (–10,000 acres).

The main crop has been harvested. The yield per acre is expected to be below the normal in all the districts due mainly to insufficiency of rainfall. In the districts of Srikakulam, Visakhapatnam, Anantapur, Cuddapah, Chingleput, South Arcot, the Central districts excluding Tiruchirapalli and the Southern districts excluding Tanjore the crop was affected by drought and the yields are expected to be very low, ranging from 55 to 70 per cent of the normal. The seasonal factor for the State as a whole works out to 70 per cent of the normal as against the final estimate of 76 per cent for the previous year. On this basis the total yield works out to 4,36,300 tons of unhusked grain or 3,49,000 tons of cleaned grain. This represents a decrease of 18·6 per cent when compared with the final estimate of 5,35,900 tons of unhusked grain or 4,28,700 tons of cleaned grain for the previous year. Compared to the average yield of 5,18,100 tons of unhusked grain or 4,14,400 tons in terms of cleaned grain for the five years ending 1949—'50, this is a decrease of 15 8 per cent. The average wholesale price of cumbu per Imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) in important market centres on the 10th March, 1951 was Rs. 8—5—0 in Guntur, Rs. 9—13—0 in Coimbatore, Rs. 8—6—0 in Tiruchirapalli and Rs. 7—8—0 in Rajahmundry.

3. **Ragi** *(Eleusine coracana)*: The area sown with ragi in the Madras State during 1950—'51 is estimated at 1,513,000 acres. Compared with the final area of 1,526,400 acres in the previous year, this is a decrease of 0·9 percent. The estimated area in the current year is lower than the average area during the five years ended 1948—'49, viz., 1,577,600 acres, by 41 percent. An area of 255,200 acres has been reported as sown under the crop since the second forecast report was issued. Compared with the final area in the previous year, the present estimate reveals an increase in the Districts of East Godavari, Krishna, Guntur, Cuddapah, Salem, Coimbatore, Tirunelveli and South Kanara and decrease in the other Districts of the State, except Malabar and the Nilgiris where the area is expected to be the same as that in the previous year. The variations are marked in the districts of Anantapur (—4,700 acres), and Coimbatore (+3,400 acres), Chingleput (—4,700 acres) and Coimbatore (+3,300 acres).

The main crop has been harvested. The yield per acre is expected to be below the normal in all the districts of the State due mainly to the failure of the North East monsoon. The yield per acre is expected to be considerably reduced in the districts of Srikakulam, Visakhapatnam, Cuddapah, Chingleput, Coimbatore and Ramanathapuram. The seasonal factor for the State as a whole works out to 70 percent of the normal, as against 77 per cent in 1949—'50 On this basis, the total yield works out to 532,200 tons of unhusked grain, (or 479,000 tons in terms of cleaned grain). This represents a decrease of 10·6 percent as compared with the final estimate of 595,400 tons of unhusked grain (or 536,900 tons in terms of cleaned grain) for the previous year. The present estimated production is lower than the average production during the five years ended 1948—'49 viz., by 647,600 tons of unhusked grain (or 582,800 tons in terms of cleaned grain) or 17·8 per cent. The average wholesale price of ragi per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important market centres on 17th March 1951 was Rs. 9—5—0 at Coimbatore, Rs. 8—6—0 at Tiruchirapalli, Rs. 7—13—0 at Guntur and Rs. 6—15—0 at Rajahmundry.

4. **Korra** *(Tenai; Setaria italica)*: The area sown with korra in the Madras State in 1950—'51 is estimated at 1,448,400 acres. Compared with the finally recorded area of 1,425,528 acres in the previous year this is an increase of 1·6 percent. The present estimate is less than the average area during the five years ended 1948—'49 (viz 1,594,300 acres) by 9·2 percent. 143,400 acres have been reported as sown under the crop since 1st January 1951. The crop is grown mainly in Guntur and the Deccan. The area estimated is the same as that of the last year in the districts of East Godavari, Tirunelveli, Malabar and the Nilgiris. A decrease in area is estimated in Visakhapatnam, Anantapur. Nellore, Coimbatore, Madurai and Ramanathapuram and an increase in area in other districts. This crop is not grown in Tanjore and South Kanara districts.

This crop has been generally harvested. The yield per acre is estimated to be below the normal in all the districts of the State. The seasonal factor is especially low in Visakhapatnam, Cuddapah, Chittoor and Ramanathapuram districts. The seasonal factor for the State as a whole works out to 79 percent of the normal as against 88 percent in the previous year. The decrease is mainly due to the continued failure of the North-East Monsoon rains. On this basis the total yield works out to 201,100 tons of unhusked grain or 160,900 tons of cleaned grain. Compared with the final estimate of 220,900 tons of unhusked grain or 176,700 tons of cleaned grain for the previous year, this represents a decrease of 9·0 percent. The average yield during the five years ended 1948—'49 was 218,200 tons of unhusked grain or 174,600 tons of cleaned grain. The estimate for the current year shows a decrease of 7·8 percent as compared with the average yield during the five years ended 1948—'49.

5. **Varagu** *(Paspalum scrobiculatum)*: The area sown with varagu in 1950—'51 in the Madras State is estimated at 1,014,600 acres for the previous year and the average area of 889,400 acres during the five years ending 1948—'49, it reveals a decrease of 8·5 percent and an increase of 14·1 percent respectively. 233,100 acres have been reported as sown since 1st January 1951. The crop is grown mainly in the Deccan except Bellary district, the Carnatic, the Central Districts and the South except Tirunelveli district. Compared with the previous year, an increase in area is estimated in Srikakulam. Bellary and Ramanathapuram district and a

decrease in area in the other Districts of the State except Visakhapatnam, East Godavari and Tirunelveli where there was no change in area. The crop is not grown in the districts of Malabar, South Kanara and the Nilgiris.

The crop has been generally harvested. The yield per acre is estimated to be below the normal in all the districts of the Madras State due mainly to the failure of the rains in the North East Monsoon period. The seasonal factor is very low in the districts of Srikakulam, Visakhapatnam, Cuddapah, Chittoor, North Arcot and Ramanathapuram. The seasonal factor for the State as a whole works out to 72 percent of the average as against 77 percent in the previous year. On this basis, the total yield works out to 280,000 tons of unhusked grain or 168,000 tons of cleaned grain. Compared with the final estimate of 315,500 tons of unhusked grain or 189,300 tons of cleaned grain for the previous year, the present estimate is a decrease of 11·3 percent. The average yield for the five years ending 1948—'49 was 201,400 tons of unhusked grain or 120,800 tons of cleaned grain.

6. **Samai** *(Panicum miliare)*: The area sown with samai in 1950—'51 in the Madras State is estimated at 451,100 acres. Compared with the final area of 441,100 acres in the previous year, this is an increase of 2·4 percent but it is lower than the average area for the five years ended 1948—'49, Viz. 479,800 acres by 5·9 percent. An area of 55,300 acres has been reported as sown since the second forecast report was issued. The crop is grown mainly in Srikakulam, Visakhapatnam, Anantapur, the Central districts, Madurai and Tirunelveli. The area estimated is the same as the final area of the previous year in the Districts of Visakhapatnam, Kurnool. Chingleput, Chittoor, South Kanara and the Nilgiris. A fall in area is estimated in the districts of East Godavari, Guntur, Cuddapah, North Arcot, Salem and Madurai and a rise in area in the other districts of the State. The crop is not grown in Krishna and Tanjore districts.

The crop has been harvested in most districts of the State. The yield per acre is estimated to be below the normal in all the districts of the State due mainly to failure of rains during the North-East monsoon period. The yield is expected to be considerably low in the districts of East Godavari, South Arcot, Chittoor, North Arcot and Ramanathapuram. The seasonal factor for the State as a whole works out to 80 percent of the normal as against 82 percent in the previous year. On this basis, the yield for the State as a whole works out to 70,500 tons of unhusked grain or 38,800 tons of cleaned grain. Compared with the yield of 70,000 tons of unhusked grain or 38,500 tons of cleaned grain in the previous year, this shows an increase of 0·7 percent, but it is lower than the average yield for the five years ended 1948—'49, viz. 64,000 tons of unhusked grain or 40,700 tons of cleaned grain, by 4·7 percent.

Cotton crop in the Madras State 1950—'51 Additional forecast Report: The area under cotton in the Madras State in 1950—'51 is estimated at 1,654,000 acres. Compared with the finally recorded area of 1,691,000 acres in 1949—'50, this is a decrease of 2·2 percent. A decrease in the estimated area in the current year as compared with the area in 1949—'50 occurs in Kurnool, Bellary, Anantapur, Nellore, North Arcot, Salem, Coimbatore, Tiruchirapalli, Madurai and Ramanathapuram and an increase in area in the other districts of the State except West Godavari and Chingleput where there was no change in area. Cotton is not grown in Chittoor and the Nilgiris districts. The main or first pickings of cotton are over in all the Districts. The yield per acre is estimated to be normal in East Godavari and Malabar and below the normal in the other districts of the State due mainly to insufficient rainfall. The crop has been affected to some extent by the incidence of pests and diseases in Ramanathapuram district.

The seasonal factor for the State as a whole works out to 87 percent of the normal as against 111 percent estimated for the final estimate of the previous year. On this basis the yield works out to 337,900 bales of 392 lb. lint as against 447,800 bales finally estimated for the previous year showing a decrease of 24·5 percent. 66,609 acres are estimated as standing on the ground for *kar* or second pickings in the Central and Southern districts. The yield is expected to be below the normal in these districts and the total yield from the *kar* or second pickings is estimated at 11,800 bales of 392 lb. lint.

The estimated area and yield under the several varieties in respect of the main pickings are given below :—

(Area in hundreds of acres, i, e., 00 being omitted; yield in hundreds of 392 lbs. lint, i. e., 00 being omitted.)

Variety	Area		Corresponding Yield	
	1950—'51	1949—'50 (Season and crop report)	1950—'51	1949—'50 (Season and crop report)
(1)	(2)	(3)	(4)	(5)
	Acs.	Acs.	Bales	Bales
Irrigated Cambodia	1,824	1,922	1,145	1,584
Dry Cambodia	999	1,094	226	329
Total Cambodia ...	2,823	3,016	1,371	1,914
Uppam in the Central Districts ...	100	114	13	22
Nadam and Bourbon	33	3	1	...
Total Salems ...	133	117	14	22
Tinnevellies*	3,992	3,948	886	1,084
White and Red Northerns ...	1,200	1,255	130	187
Mungari	1,958	1,954	223	277
Westerns	5,762	5,986	643	857
Warangal and Cocanadas ...	638	610	108	4
Chinnapathi or short staple	34	24	4	4
Total ...	13,584	13,777	1,994	2,542
Grand Total ...	16,540	16,910	3,379	4,478

* Includes Karunganni cotton in Coimbatore district and Uppam, Karunganni and mixed country cotton grown in the South.

The table below gives final information so far as it is available regarding the crop of 1949—'50 :—

(Figures in hundreds of bales of 392 lbs. lint i. e., 00 being omitted)

Items nd Particulars	South		Deccan Northerns and Westerns	Rest of the State Cocanadas and others	Total
	Tinnevellies and Salems	Cambodia			
(1)	(2)	(5)	(6)	(8)	(8)
	Bales	Bales	Bales	Bales	Bales
1. Pressed at presses and loose cotton received at mills in 1950—51	684	1,115	1,178	129	3,106
2. **Subtract** stocks of loose cotton held by the trade on 31-1-1950	97	10	2	16	125
3. **Add** stocks of loose cotton held by the trade on 31-1-1951	65	83	35	251	434
4. **Add** Estimate of extra factory consumption	37	...	38	25	100

(1)	(2)	(5)	(6)	(7)	(8)
5. Total crop of 1949–'50	689	1,188	1,249	389	3,515
6. Yield as estimated for 1949–1950	1,106	1,914	1,321	137	4,478
7. Yield as estimated in the season and crop report of 1949–'50	1,106	1,914	1.321	137	4,478

Notes:— (1) The year 1950—'51 relates to the period 1st February 1950 to 31st January 1951 when the crop of 1949—'50 generally comes into the market. The early sown crop in the Deccan however generally comes into the market from December in each year. The figures are taken from the weekly cotton returns furnished by mills and presses.

(2) Item 4 :— The figures are approximate.

Cotton Crop Madras State 1951—'52—Intermediate condition report—Period upto the end of August, 1951. The main season for sowing of cotton crop is not yet over in most parts of the State. Sowings of the crop are in progress in Kurnool, Bellary, Anantapur, Cuddapah, Chingleput, North Arcot, Salem, Tiruchirapalli and Malabar districts. The condition of the early sown crops is reported to be generally satisfactory except in Anantapur Cuddapah and Madurai districts where the yield may be affected by inadequate water supply. The crop in West Godavari district is also reported to have been affected due to heavy rainfall in the district in the months of June and July, 1951. In some parts of Tirunelveli district the standing crop is reported to have been pulled out and replaced with paddy due to stagnation of water. The wholesale price of cotton lint per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on the 8th September 1951 was Rs. 80—13—0 for Cocanadas, Rs. 93—10—0 for White Northerns, Rs. 94—13—0 for Red Northerns, Rs. 82—13—0 of Western—Mungari, Rs. 87—1—0 for Westerns—Hingari, Rs. 105—13—0 for Coimbatore Cambodia Rs. 95—8—0 for Coimbatore Karunganni, Rs. 86—1—0 for Tinnevellies and Rs. 63—0—0 for Nadam Cotton. Compared with the prices published in the previous report i. e., those which prevailed on August 1951, these prices reveal a fall of 1·8 per cent in the case of Cocanadas the prices of the other varieties remaining stationary.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1951 to 31—8—1951 amounted to 2,08,524 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 2,58,513 bales. 2,82,699 bales mainly of pressed cotton were received at spinning mills and 5,568 bales were exported by while 91,622 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture, Madras)

Sugarcane Crop, Madras State - 1951 - 1952. The condition of the sugarcane crop in the Madras State is reported to be generally satisfactory except in Anantapur, Chingleput and Coimbatore districts where the yield of the crop may be affected to a certain extent due to the inadequate water supply. The standing crop in West Godavari district is reported to be showing signs of vegetative growth after the recent wet weather and floods in June and July 1951. The area damaged by floods is however comparatively small.

2. The wholesale price of jaggery per imperial maund of 82 2/7 lbs. on the 8th September 1951, was Rs. 23—1—0 in Adoni, Rs. 20—9—0 in Mangalore, Rs. 19—0—0 in Cuddalore, Rs. 18—12—0 in Rajahmundry, Rs. 18—2—0 in Bellary, Rs. 10—1—0 in Visakhapatnam, and Vijianagaram, Rs. 18—0—0 in Sulur, Rs. 17—3—0 in Vellore, Rs. 17—0—0 in Chittoor Rs. 16—7—0 in Kakinada and Rs. 15—7—0 in Coimbatore. Compared with the prices published in the previous report i. e., those which prevailed on the 9th June 1951 these prices reveal a rise of approximately 21·3 per cent in Adoni, a fall of approximately 18·8 per cent in Coimbatore, 12·1 per cent in Kakinada, 4·5 per cent in Vellore, 0·9 per cent in Mangalore, the prices remaining stationary in Visakhapatnam, Vijianagaram, Bellary, Cuddalore, Salem, Chittoor and Rajahmundry. [Government of Madras Public (Economic and Statistics) Department.]

Weather Review — For September 1951

RAINFALL DATA

Division	Station	Total rainfall for the month	Departure from normal in inches	Total since 1st January in inches	Division	Station	Total rainfall for the month	Departure from normal in inches	Total since 1st January in inches
Orissa & Circars	Gopalpur	7·1	—0·4	35·1	Central Contd.	Coimbatore	3·6	+2·0	13·9
	Calingapatnam	7·6	+0·7	32·5		Tiruchirapalli	2·2	—1·8	20·1
	Visakhapatnam	7·6	+1·0	34·2	South	Nagapattinam	0·8	—2·5	17·2
	Araku Valley*	8·7	—0·5	57·9		Aduturai*	5·8	+1·8	17 5
	Anakapalle*	4·3	—3·5	38 5		Pattukottai*	3·2	—0·8	15·2
	Samalkot*	4·7	—1·6	31·1		Madhurai	8·7	+4·0	27·7
	Kakinada	8·1	+1·9	35·3		Pamban	2·1	+0·7	16·4
	Maruteru*	8·8	+1·3	45·6		Koilpatti*	1·6	—0·7	15·6
	Masulipatnam	5·4	—1·0	32·1		Palayamcottai	2·1	+0·9	14·2
	Guntur*	1·8	—3·5	23·2		Ambasamudram*	6·3	+5·2	23·0
	Agri. College, Bapatla*	5·2	—2·1	24·5					
	Agri. College, Farm, Bapatla*	5·2	X	26·9	West Coast	Trivandrum	9·3	+4·8	48·6
	Rentachintala	1·7	—3·1	16·6		Fort Cochin	12·0	+4·3	82·1
Ceded Districts						Kozhikode	7·3	+0·7	89·1
	Kurnool	5·1	—0·9	25·0		Pattambi*	13·3	+7·7	71·4
	Nandyal*	3·0	—3·8	22·5		Taliparamba*	10·1	—0·6	103·8
	Hagari*	7·2	+2·3	18·4		Nileshwar*	10·1	—3·5	101·7
	Siruguppa*	5·5	—0·9	15·8		Pilicode*	9·2	—2·5@	100·9
	Bellary	7·8	+2·9	20·7		Mangalore	10·9	+1·5	111·0
	Cuddapah	2·6	—3·4	15·9		Kankanadi*	10·8	—1·6	107·7
	Kodur*	2·5	—1·5	15·3					
					Mysore & Coorg.	Chitaldrug	5·8	+1·4	18·9
Carnatic	Nellore	3·4	—1·1	13·3		Bangalore	10·3	+3·6	28·4
	Buchireddipalem*	5·8	+2 1	12·4		Mysore	7·7	+2 7	21·8
						Mercara	13·3	+2·2	110·8
	Madras (Meenambakkam)	3·2	—1·5	17·4	Hills	Kodaikanal	10·2	+2·9	57·9
	Tirurkuppam*	2·9	—4·0@	18·7		*Coonoor**	8·5	+5·0	45·1
	Palur*	2·7	—4·5	22·2		Ootacamund*	7·5	+2·9	37·9
	Tindivanam*	4·9	—1·3	17·2		Nanjanad*	9·3	+3·7	51·5
	Cuddalore	1·1	—4·1	16·5					
Central	Vellore	0·4	—1·5	22·2					
	Gudiyatham*	2·8	—1·8	13·4					
	Salem	6·6	+0·5	23·6					
	Coimbatore* (A. M. O.)	2·2	+0·7	9·4					

Note:—

1. * Meteorological Stations of the Madras Agricultural Department.
2. @ Average of eight year's data for Tirurkuppam, nine year's data for Pilicode, and seven years' data for Arakuvalley is given as normal.
3. Average of ten years' data is taken as normal.
4. X The farm was started only this year.

Weather Review For September, 1951

The shallow depression, which passed inland into Orissa on the last day of August, 1951, merged with the seasonal trough of low pressure on 1—9—1951 and extended up to the Circars Coast and over the central parts of the India and became unimportant on 4—9—1951. A cyclonic circulation existed over Saurashtra, Kutch, Rajasthan and neighbourhood on 1—9—1951. A low presure wave from the last was approaching Central and Upper Burma on 2—9—1951. It moved westwards causing unsettled conditions over the North and the adjoining east-central Bay and simultaneously becoming weak while moving westwards, and this state continued till 9—9—1951. Under its influence the monsoon strengthened over Rayaleseema on 6—9—1951, where widespread rains occurred. Another low pressure wave was passing westwards across Central Burma on 8—9—1951 and it caused a land depression over Eastern Pakistan and lay as a deep depression over Gangetic West Bengal on 10—9—1951. It moved towards Vindhya Pradesh and adjoining parts and finally became unimportant on 14—9—1951. Pressure generally increased over the whole country on 14—9—1951 and "Break" conditions in the monsoon had set in and the monsoon continued to be weak over the whole country except Assam, and even withdrew temporarily on 21—9—1951. A low pressure wave passed west wards across Comorin-Maldives area on 15—9—1951. An upper air anti-cyclonic circulation existed over the Peninsula on 16—9—1951 and moved towards North-West and lay over Rajasthan on 23—9—1951. A well-marked trough of low pressure lay over the West Central Bay of Bengal on 25—9—1951 which persisted, and became a shallow depression within a degree of Lat. 13 N. E. Long. 83 E. on 30—9—1951. Meanwhile another trough of low pressure existed in the east Arabian Sea, off the Malabar S. Kanara and South Konkan Coast on 26—9—1951, which persisted upto the end of the month. Under the influence of these two "lows" widespread heavy rains occurred along the West Coast and Coastal Andhradesa and localised rains occured elsewhere in the region.

Particulars regarding the noteworthy falls and zonal rainfall during the month are furnished below :—

S. No.	Date	Place.	Rainfall in inches for past 24 hours.
1	26—9—51	Fort Cochin	3·6
2	27—9—51	Alleppey	3·5
3	28—9—51	Trivandrum	2·8
4	29—9—51	Kakinada	4·5
5	,,	Vizagapatnam	3·1
6	,,	Bangalore	2·9
7	,,	Ootacamund	2·6
8	30—9—51	Mangalore	4·3
9	,,	Mercara	3·8
10	,,	Kozhikode	3·1

ZONAL RAINFALL

S. No.	Name of the Zone	Total Precipitation
1	Orissa and Circars	Below Normal
2	Ceded Districts	Below Normal
3	Carnatic	Far Below Normal
4	Central	Below Normal
5	South	Above Normal
6	West Coast	Above Normal
7	Mysore and Coorg	Above Normal
8	Hills	Far above Normal

Agricultural Meteorology Section,
Lawley Road Post, Coimbatore,
Dated 8th October, 1951.

M. B. V. N., C. B. M., & M. V. J.

Departmental Notifications

GAZETTED SERVICE – APPOINTMENTS

Sri C. V. Govindaswami, Assistant in Mycology, is appointed to act as Lecturer in Mycology, Agricultural College, Bapatla.

Sri M. Kandaswami, Assistant Mycologist, (Ergot Scheme) Ootacamund tobe Assistant Mycologist, Coimbatore.

Sri K. V. Srinivasan, Lecturer in Mycology, Agricultural College, Bapatla to be Assistant in Mycologist (Ergot Scheme) Ootacamund.

Sri A. K. Subramaniam, Agricultural Engineer Supervisor is appointed as officiating Assistant Agricultural Engineer (Inspection), Vellore.

Messrs. C. R. Subramaniam, C. Kamalaratnam and P. K. Radhakanth are selected by the Public Service Commission and appointed as Assistant Agricultural Engineers (Inspection) and posted to Trichinopoly, Vijayawada and Madras respectively.

SUBORDINATE SERVICE

Appointments

The following B. Sc. (Ag) candidates are appointed as upper subordinates and are posted to the vacancies against each :—

Sri Appa Rao Reddy, B.	...	Assistant in Chemistry, Coimbatore.
,, Balagopalan, K.	...	Assistant in Chemistry, Soil Survey Scheme, Coimbatore.
,, Bala Rámudu, K.	...	Assistant in Chemistry, Coimbatore.
,, Chenulu, A.	...	Teaching Assistant, Agricultural College, Bapatla.
,, Koteswara Rao, S.	...	Assistant in Chemistry, Coimbatore.
,, Rama Rao, D. V.	...	Assistant in Chemistry, Soil Survey Scheme, Coimbatore.
,, Srimanarayana, U.	...	Assistant in Paddy, A. R. S. Tirukuppam.
,, Subramaniam, A.	...	Assistant in Chemistry, Coimbatore.
,, Subramaniam, K.	...	A. D., Parvathipur.
,, Venkatanarayana, T.	...	Assistant in Chemistry, Coimbatore.
,, Venkatapathi, T.	...	Assistant in Botany, Coimbatore.

POSTINGS AND TRANSFERS

Names	From	To
Sri Appalanarasiah, P.,	Asst. in. Mycology, Anakapalle,	P. P. A. (Mycology), Srikakulam.
,, Augustine, K. P. R.,	A. D., Kaikalur,	Assistant in Chemistry, Soil Survey Scheme, Coimbatore.
,, Balasubramaniam, P.	A. D., Kurnool	F. M., A. R. S., Nileshwar.
,, Chandy, K. C.,	Post Graduate Training in Entomology, New Delhi,	Asst. in Entomology, Coimbatore.
,, Dharma Rao, C.,	Asst. Chemistry, Coimbatore,	Chemical Analyst, Bapatla.
,, Dharmalingaswami, P.,	F. M., A. R. S., Hagari,	Asst. Fertiliser Inspector, Vellore.
,, Gopa'akrishniah, K. V.,	A. D., Tenali,	A. A. D., Rajampet.
,, Gopala Rao, K.,	A. D , Guntur,	A. A. D., Repalle.

Names	From	To
Sri Govinda Iyer, T. A.,	Asst. in Chemistry, Coimbatore,	Asst. in Chemistry, Soil Survey Scheme, Coimbatore.
,, Gopalakrishnan, R.	A. D., Virudachalam,	A. D., Saidapet.
,, Hanumantha Rao, M.	Special A. D., Manure Scheme, Tenali,	A. A. D., Ongole.
,, John Durai Raj,	Asst. in Chemistry, Coimbatore,	Analytical Chemist, Coimbatore.
,, Krishnamaraju, K.	Special A. D., Manure Scheme, Tenali,	A. A. D., Tenali.
,, Koteswara Rao, K.	Special A. D , Manures Scheme, Bapatla,	Manures Scheme, Bapatla.
,, Lakshminarayana, E.	A. A. D., Repalle,	A. D., Banganapalle.
,, Mohammad Mafuddin,	Special A. D., Manures Scheme, Gudivada,	A. D., Kamalapuram.
,, Madhava Rao, S.	Special A. D., Manures Scheme, Masulipatam,	Special A. D , Manures, Ellore.
,, Narayanaswami, K. R.	Seed Development Asst. Pattukottai,	A. D., Tanjore.
,, Narasimhamurthi, B. L.	On leave,	Millet Asst , Tirupathur.
,, Pullayya, K.	A. A. D., Rajampet,	Chemical Analyst, Bapatla.
,, Padmanabha Rao,	Fruit Asst., Kodur,	Inspector of Fruit Products, Telugu Area.
,, Ramachandran, S.	F. M., C. F., Coimbatore,	A. D., Periakulam.
,, Raman, A.	F. M., A. R. S., Taliparamba,	A. D., Tellicherry.
,, Ramakrishna Rao,	Special A. D , Manures Scheme, Chirala,	A. D , Madekasira.
,, Raghava Rao, K. V.	Special A. D., Manures Scheme, Kaikalur,	A. A. D., Kaikalur.
,, Rama Mohan Rao, K.	F. M., A. R. S., Guntur,	A. D., Parvatipur.
,, Ramaswami, A. N.,	Asst., in Chemistry, Coimbatore,	Analytical Chemist, Coimbatore.
,, Somayajulu, P. L. N.,	On leave,	Asst., in Mycology, Anakapalle.
,, Sasibusham,	A. D., Harur,	Asst., in Chemistry, Soil Survey Scheme, Coimbatore.
,, Sakarama Rao, J.	Asst . in Botany, Coimbatore,	Asst., in Botany, Coimbatore, for the revision of the Hand-book of S. Indian weeds.
,, Subramaniam, P. T.	A. D., Tellicherry,	F. M., A. R. S., Talipramba.
,, Satyanarayana, T.	Special A. D., Manures Scheme, Bapatla.	A. D., Bapatla.
,, Satyanarayana, P.	do. Guntur,	A. A. D., Guntur.
,, Satyanarayana, K.	do. Guntur.	A. D., Kurnool.
,, Suryanarayanamurthi, T.	do. Vijayawada,	Asst. in Chemistry, Soil Survey Scheme, Coimbatore
,, Subramaniam, K.	A. D., Parvathipur,	A. D., Virudachalem.
,, Sambamurthi, K.	On leave,	Fruit Asst., Kodur.
,, Shanmugham, C.	A. D., Tirunelveli,	A. A. D., Tirunelveli.
,, Vasudeva Rao, S.	Special A. D., Manures Scheme, Repalle,	Cotton Asst. A. R. S., Nandyal.
,, Venkataraman, C. R.	Asst., in Chemistry, Coimbatore,	Asst., in Chemistry, Soil Survey Scheme, Coimbatore
,, Venkatasubaramaniam, V.	A. D., Ambasamudram,	A. D , Tirunelveli.